

HOME GARDENING



PRATIBHA P. TRIVEDI



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Pratibha P. Trivedi



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FOREWORD

GARDENS add to the quality of life and gardening is an absorbing pursuit. As the well-known gardening authority, Christopher Lloyd, says, "Gardening is one of those creative activities that produces an enjoyable sensation of enjoyment". He goes on to say that it "keeps us in touch with the earth, the seasons, and with that complex of interrelated forces both animate and inanimate, which we call nature. It is a humanising occupation".

In India, we are fortunate to possess one of the richest floras on this earth, and a tremendous range of bioclimatic regions which make it possible to grow flowers, fruits and vegetables in a variety of forms which it is difficult to match elsewhere; we are in a position to enjoy the choicest varieties both of the temperate and the tropical zones. Keeping this in view it is rather disappointing that gardening, and especially home gardening, is so limited in most parts of our country. We do indeed have some magnificent parks and public gardens including the botanical gardens, and those individuals here and there who maintain exquisite private gardens, searching all the time for choice of new varieties and sparing no pains to make the spaces at their disposal into gardens of delight. Again, due to good planning and the enthusiasm of some, we have fine plantations of roadside trees in a few cities like Bangalore, Chandigarh and New Delhi. But, by and large, it is unfortunately true that our country is not a land of gardens.

Yet, most people do have an instinctive love of flowers and do appreciate fruits and vegetables. Perhaps what deters them from taking up gardening is the absence of well-stocked garden shops and the feeling that gardening is a mystique only successfully comprehended by those blessed with 'green fingers'. But if one has a love of flowers, fruits and vegetables in one's heart, the 'green fingers' soon develop. Mrs Trivedi's book fills the need which has been long felt for a simple book for home gardeners which will dispel any feeling about gardening being a mysterious process and provide the authentic information the average gardener seeks.

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Whereas in temperate climes, the gardener has a wide range of excellent books to choose from, in the tropics and semi-tropics the selection available is much less and there are hardly any books at all for the home gardener in India. It is fortunate therefore, that Mrs Trivedi has been able to prepare the present book. As one who had the privilege of working with her as a colleague for some time I can personally testify to her deep interest in the subject and her practical experience in matters pertaining to the home garden. This has resulted in a volume which is packed with the kind of information the average gardener requires. It is punctuated with personal notes which make the book lively and add to its value.

I have no doubt that this is a most useful addition to the scanty literature on gardening in India and that it will be widely welcomed.

New Delhi

B.P. PAL

PREFACE TO SECOND EDITION

TO my surprise and gratification this book has gone into the second edition. The invitation of the Indian Council of Agricultural Research coincided with the completion of my second posting at Shillong and at Guwahati. Since publication of the first edition, I had the experience of having to make do with a terrace garden in a Delhi flat. Despite many constraints, certain of its advantages opened up new frontiers. At Shillong, the official residence had a large garden tended by successive officers with alternating care, whim or neglect. But some of its features developed many years ago still held and I learnt more about the basic principles of laying out a garden. It was also an exercise in landscaping and large-scale gardening. At Guwahati also, the official residence had a large garden which, due to differences of topography and climate and planning of a balance between flowers, vegetables and fruits against the back-drop of a surrounding hill and the magnificent vista of the mighty Brahmaputra in the front, presented some interesting features. Some of these experiences have gone into this revision.

Gardening makes for rootedness and is both a physical disadvantage and an emotional wrench for a transferable officer. Those only who have to bid farewell to their garden, when their efforts come to bloom, know what they suffer. They have to learn to rejoice in its memory only. The photography to which I took to, is an extension of the joy and the memory.

Dr B.P. Pal continued to guide, advise and direct this quest in search of expression. Shri Krishan Kumar provided the anchor for production of the book and, as usual, brought to bear upon it his stamp of quality. The artistry of Shri M.K. Bardhan is reflected in the cover painting and the art and craft work of the book. I had many useful discussions with Shri V.A. Parthasarthy who helped me in updating the chapter on Vegetables and gave valuable suggestions. Dr Virendra Kumar with his vast experience of trekking in the Himalayas and with his wonderful library of photographs has helped me generously with the photographs. Brother George of the Sacred Heart College,

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Shillong, has contributed, among others, the memorable photograph of *Ginkgo* in all its golden glory. I remember and miss the indefatigable late H.K. Gorkha, whose photographs were creations of art.

Dr N.S. Randhawa with his positive and ready approach made it a pleasure to revise the book. Dr R.N. Prasad and his team lent their helping hands with up-to-date information on various matters with special reference to the north-east. Dr B. Choudhury made last-minute corrections which were valuable.

I am touched by the care and attention Shri Lokendra Deb brought to bear upon the typing of the manuscript.

When I struggle with botanical names, I remember late Dr T.B. Menon, whom I met at Shillong in 1967 as Director of Health Services, Assam. He inspired confidence in me to pick up the difficult, unfamiliar names and never tired of my enquiries. And I remember late Shri Harishwar Deka, Orchidarium Assistant of Botanical Survey of India, Shillong. He had a wonderful memory and a sixth sense for identification of plants. I could always depend on him for my small world of flora.

In the first edition, I could include only a few of those to whom I am indebted for help, assistance and suggestions. My debt has further increased while bringing out this edition.

New Delhi

PRATIBHA P. TRIVEDI

PREFACE TO FIRST EDITION

WHEN I was in Shillong (Meghalaya) I had a small garden which I cultivated with much enthusiasm. I was fortunate to spend about 10 years in that beautiful station which abounded in good gardens and many more keen gardeners. The interest in gardening was not confined to a few relatively well-to-do people but was shared by the people as a whole. Even a modest house in a village could show some lovely bloom which would be the pride of a humble mason or a carpenter. Indeed the place itself bathed with sunny resplendence after a sharp shower, its whispering glades of pines, and its green splendour was a garden designed by nature.

When I left this for New Delhi I suffered greatly and longed for my garden in Shillong. After many a tearful remembrance of it I found myself recapturing scene after scene of its changing moods in various seasons. I recalled many a tip I had gathered from experienced gardeners, professionals and amateurs of all classes. In the Indian Council of Agricultural Research, I came in contact with the best brains which had devoted a lifetime to the study of horticulture. I decided to embark on the next best thing to making a garden—writing about it.

I am very fortunate and privileged in having Dr B.P. Pal as my guide. His great talent in constantly striving for excellence whether it be a draft of a letter or growing of a rose, has, I hope, disciplined my enthusiasm into a measure of coherence.

I am indebted to Dr T.K. Bose who was patient with an amateur's manuscript and filled in the gaps. Shri H.K. Gorkha's artistry in photography has succeeded better in communicating than my halting prose. Shri Krishan Kumar provided the anchor for all work relating to production. Shri N.S. Bisht supplemented the write-up with his fine line drawings. Shri P.L. Jaiswal and Dr (Mrs) A.M. Wadhwani brought to bear on the book their meticulous scrutiny as editors and gave it the finishing touches.

Dr N.V. Sundaram guided me in the preparation of the chapter on Plant Protection. But for Shri Romesh Chandra's help, collection of photographic material would have been difficult. Dr B. Choudhury and Dr R.N. Singh went through the

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manuscript of vegetables and fruits respectively and gave very useful suggestions. Shri Mohanlal took great pains in flawless dictation and typing. Shri S.R. Bhardwaj supplemented it. I am grateful to innumerable friends in Assam, Delhi, Jabalpur and all over India for the scraps of information from which this book is planned.

I would deem myself amply rewarded if this book encourages anyone to grow a plant he has not done before. To the beautiful plants not included due to my ignorance or the limited scope of the book, I owe an apology.

The preference here are personal and claim no superiority over others. I am painfully aware of the limitations of information given and the lacunae in the acknowledgement.

New Delhi

PRATIBHA P. TRIVEDI

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FOR the first edition, I was grateful to a number of gardeners in New Delhi, Smt. Pratibha Vedagya, Residential Quarters, St. Stephen's College; Shri Narayan Potti, No. 15 President's Estate; Shri Arjun, C-23 Defence Colony; Shri Dogra, Lala Bharat Ram and Shri J. Swaroop, retired Head Clerk, St. Stephen's College for permitting to take photographs of their gardens. Most of the photographs of cacti and other succulents were taken in the garden of Shri Alok Jain. The photographs were also taken in the Buddha Jayanti Park, the IIT Campus, Delhi University Campus, Lodi Garden, Teen Murti House and the farm of Lala Bharat Ram.

Twenty-six photographs at Sl Nos 12, 13, 17, 35, 36, 38, 40, 41, 43, 44, 50, 51, 52, 55, 65, 66, 67, 69, 71, 72, 78, 79, 84, 85, 106 and 107 have been taken by Dr Virendra Kumar of Zakir Hussain College, 8 photographs at Sl Nos 34, 39, 42, 64, 77, 80, 83 and 140 are by Brother George of the Sacred Heart College, Shillong; photograph at Sl No 75 is from the collection of Dr B.P. Pal, at Sl Nos 23 and 24 are by courtesy *The Rose in India* by B.P. Pal; at Sl No 53 is by courtesy *The Beautiful Climbers of India* by B.P. Pal; at Sl Nos 138, 139 and 141 of fruits were taken by Shri Mohan Lal of the Indian Agricultural Research Institute, New Delhi; at Sl Nos 54 and 76 are by Shri Ashok Dilwali; at Sl No. 105 is by Dr R.L. Misra; at Sl No 22 is from IARI collection; at Sl Nos 25, 26, 27, 28, 57, 62, 63, 103, 119, 120, 123-137, 140, 147, 148 and 149 are from the ICAR collection and at Sl Nos 3 to 7, 117, 122 and 144 are from the ICAR (NE Region). The photographs at Sl Nos 19, 32, 49, 68, 70, 73, 74, 81, 82, 115 and 142 are not so successful an attempt of mine at photography. All other photographs have been taken by late Shri H.K. Gorkha. The fine line drawings made by Shri N.S. Bisht continue to be an attraction of the book. The line drawing on 'garden implements' was provided by the ICAR (NE Region).

For the first edition, late Shri S.L. Katyal, Assistant Director-General, ICAR, gave unstinted support to this project. Dr V.S. Seshadri, IARI, very kindly helped to check the necessary details. Shri L.C. Sikka, Central Potato Research Institute, Shimla, helped with the material on potato.

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For the second edition, Dr (Mrs) A.M. Wadhwani has again brought to bear on the book the meticulous scrutiny of the editor ably assisted by Shri Rajinder Singh. Shri J.B. Mehra provided valuable technical support for production. In addition to Dr R.N. Prasad, Director, NEH Research Complex, ICAR, Shillong, I have drawn on the help for updating the material of Dr P.N. Gupta in the chapter on 'Fruits' and Dr S.K. Gangwar, Entomologist, Dr Z.N. Verma, Pathologist and Dr M.D. Singh, Engineer, in checking the respective subjects.

Messrs Thomas Nelson & Sons Ltd and Graham & Graham Solicitors have very kindly consented to the reproduction of the line drawing from Mr T.P. Barneby's *European Alpine Flowers in Colour* on 'the shapes of leaves and floral parts'.

I owe a special debt to my *mali* Narendra Prasad Singh for his unstinted support to my gardening ventures.

I am unable to acknowledge my gratitude to all who have helped me in various ways, I thank them all.

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1

INTRODUCTORY

ON seeing a good garden, friends exclaim “You really have green fingers!” You get green fingers not by merely possessing a garden or good seed or paid labour, but by loving your garden. With a quiver in your heart, you look for the first pair of leaves, coming out of the seed planted a few days back. You want to cry with joy because you had the first gladiolus in the season, like the birth of the first baby in the house. Then, one by one, plants are dying due to an unidentified disease and, before the entomological or pathological help has reached, they are beyond retrieval — you feel sad. It, really, is a true world.

Gardening is a science because precise knowledge regarding material, practices, diseases, etc., is required to become a really good gardener. But it is not enough. It is the love for gardening which sustains the knowledge. It creates around you a world of romance and love and of art. Professional competence may at times be devoid of such emotions and results are not always encouraging.

When you sit on your lawn carpet and look at the blue sky with specks of clouds, playing hide and seek on a sunny day in winter, you are reminded of “All things bright and beautiful”.

The contact with nature constantly reminds you of its dictum, “Accept me for what I am”. Each flower, whether small or big, single or double, with or without fragrance, has a distinctive personality, beauty and charm. The tiny flower of *Euphorbia splendens* is as distinctive as a decorative dahlia. It would be awfully dull to have all flowers, big and double, like dahlias. We do not, similarly, want all intellectual giants among men. Each one is a God’s gift and according to his personality, the old and young, tender and coarse, loud and soft, each one has a little place for itself. As I had been writing this book, I watched, a ‘John F. Kennedy’ rose form into a tiny bud, grow into a handsome white, pearl-like flower and mature like a wise, dignified man who lived his life usefully.

The garden constantly reminds you, “Never take any plant for granted”, just as you should never take any human being or situation for granted. There are water plants

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which grow only in water, there are rock plants which love to be among the rocks, there are shade-loving plants and there are sun-basking plants. There are creeping plants like *Ficus repens* and there are tall erect plants like poplars. There are compact perennial bushes and there are annuals. Each plant has to be understood, cared for and tended.

“To each one according to his need” is the right motto for the garden. If you crowd the plants, there is competition for survival. If you do not take remedial action to set right over-crowding there will be casualties or stunted growth. The cuttings, seedlings or plants, therefore, need to be immediately separated after they have become over-crowded and given their separate positions.

A garden fulfils the urge for creation — the ever-haunting urge in great musicians, painters, sculptors — though at a lower platform. The completion of the life-cycle of an annual plant from seed to flower, to seed and extinction is the eternal truth.

A garden also satisfies your instinct for artistic arrangement. There may be a rectangular formal lawn with formal rectangular beds and formal erect junipers and conifers all arranged as if ready in battle-dress for a march. There may, on the other hand, be informal clusters of plants as if seeds were thrown at random and they grew thus because they could not help growing. Various colours and form combinations are possible through matching and contrasting flowers and foliage, and their training.

It is interesting to watch how flowers change their colour with growth. A chrysanthemum flower which looked pure white at the initial stage, develops a little lilac as it advances and, before falling, becomes completely lilac-mauve. The flowers also change their colour tone during different seasons. So do the personalities of human beings develop with age and environment.

A latent desire for experimentation also finds expression in gardening. Having studied the behaviour of the plant, you may like to make your experiments with new varieties, new cultural practices or even in breeding. It is not necessary that breeding should be confined to professionals.

A garden can be a showpiece which you may show to visitors with a sense of pride. It is also a place for your relaxation. You may not like your garden to be always clean or tidy or, at least, not the whole of it. The carpet of fallen petals of flowers or bracts of *Bougainvillea*, *Tibouchina*, *harsinghar* (*Nyctanthes*), rose standards, wild rose (*Rosa indica*) or *Jasminum pubescens* is a delightfully fresh sight and, in the name of tidyness and cleanliness, I would feel pained if these petals were to be removed.

The craving for possessing beautiful plants leads you to acquire more than you can accommodate in your small garden. To obviate this danger, you have to ruthlessly check this desire.

The plants must fit in the general plan of the garden.

A plant is demanding but it never comes to you, you have to go to it. It may be crying for water or food or it may be feeling too hot or cold. Therefore, no gardening can be done by sitting in an easy chair, reading library books on gardening. You have to come out and be with the plants. Their company will grow on you and you would not like to

miss a chance to be out of the library into the garden.

I make a distinction between a garden-owner and a gardener. A garden-owner will visit a garden or sit outside in the garden, enjoy it for a short while or show it with pride to the visitors, and then forget it. A gardener will not only enjoy a garden but also work for it. You have to be a gardener to make a good garden.

The exact period of flowering or fruiting cannot be predicted as there are factors of wind, rain and sun beyond the control of the gardener. It may also vary with the location. The periods of flowering given in this book are, therefore, approximate.

Giving the measurements in the Metric as well as British scales may seem odd but has been done to cater to the need of the readers who think in terms of either of the scales. The conversion is not exact as the heights, distances and depths are generally approximations depending on a large number of factors such as variety, position, location, season, manures, irrigation, pest and disease control, etc. Those who think in terms of either scale do not think in such precise measures that the height of 10 ft should be 2.997 m.

In India, we are lucky to have a wide range of agro-climatic conditions varying from tropical to subtropical and from subtropical to submontane and temperate. The rainfall varies from almost nil, i.e. 13 cm (5 in.) in Rajasthan to 1,080 cm (435 in.) in Cherrapunji in the eastern hills (Meghalaya State) to the average rainfall in the plains of about 107 cm (40 in.). The altitude varies from sea-level to over 3,500 m (11,000 ft). The latitude is from near the Equator 8° north to 38° north, while the longitude varies from 69° east to 97° east. It is, therefore, not possible to do justice to gardening under such varying conditions in a small book like this. The reader will find a bias towards conditions prevailing in north India and in the eastern hills of which I have more experience. The experience can be usefully applicable to other countries having similar agro-climatic conditions.

A garden in your home is your place of beauty and relaxation and, therefore, let the choice of plants, design, harmony and balance be as you would like them and not as any other gardener advises. This book, therefore, only gives general guidelines and leaves the final choice to you. The success of gardening lies in understanding the plant. The best lessons can be learnt by seeing them grow in their natural habitat. If this is not possible, the next best method is to see them growing happily in another garden and watch their behaviour.

Make a garden you can enjoy and not one which becomes burdensome. The work should not be beyond your capacity or the help which you are likely to get.

Too much need not be made of the colour scheme or colour clash as you read in the books. Follow your instinct. If you like a dazzling colour combination, go ahead and try. You may hit upon a violet and orange scheme, like *Delphinium* and *Eschscholzia*. You may incorporate such features of gardening as you like and the space permits but no more.

The rustling noise made by trees is tempting. It may remind you of your childhood,

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when you played truant and went to the jungle to collect wild berries! If the size of your garden permits, why not allow a small portion to grow wild! I still remember the pleasure of allowing bamboos and under-shrubs to grow wild in a small portion of my garden at lakeside Cottage in Shillong with *Hedychium* in the front to give it a neat front line and pink *Dombeya* and a wild plum tree growing among them. After 3-4 years, it grew and so, too, a number of wild plants. I enjoyed collecting them and getting them identified at the Botanical Survey of India. The excitement of exploration too! Later, I felt a dizzy excitement of exploring and following up in my garden 'Lumpyngnad' (translated, as 'a pleasant hill') at Shillong.

Permit me to tell you a story related by a friend. Two brothers got their share of ancestral land, kept fallow over a long period. One borrowed a neighbour's bullocks, purchased water from another neighbour, took a loan and purchased seed and fertilizers and cultivated his land. By the end of the season, he could purchase his own bullocks, dig a tubewell and get the best seeds. The other one purchased sturdy bullocks, constructed a tubewell and drains and became bankrupt by the end of the season! So, better not to try to collect all knowledge and tools, on the subject, before starting gardening. Just pick up a spade, collect a handful of seeds and sow them. You will soon become a gardener and share the pleasure of gardening with others.

2

GARDEN PLANNING

PLANNING a garden is as essential as planning a menu for a party. Without planning, the plants may grow, and be healthy too, but will not be able to create any effect. The effect proposed to be created should, therefore, be clear in one's mind like a painting. It is a useful exercise to draw the plan on a graph paper with proposed positions, the heights of the plants and even their shapes wherever possible. It is stimulating to draw and redraw, fix and refix the positions, until a plan to your satisfaction emerges and it is exciting to see the garden shaping itself according to the picture visualised earlier.

It is futile to go into the merits of a formal or informal garden, as this is a matter of personal preference. The chief features of a garden are its naturalness and beauty and it should satisfy this criteria whether it is formal or informal. To meet this requirement, the garden should have colour, harmony and balance. It looks beautiful if each plant is healthy, has a corner to itself and shows its personality. The effect should be pleasing as well as relaxing.

Whether it is a formal or an informal garden, a lawn, like a canvas for the painting, is essential. The hedges suitably encircling the garden or rounding off different portions, provide an attractive framework, break its monotony and lend it a personal touch.

Originality in planning. The originality of the gardener will bestow originality to his garden. A graceful bend somewhere dotted with a beautiful flowering shrub, a green sloping corner for ferns, or an unusual arrangement say for hanging of orchids, would add to the charm of the garden. A large compound may be sub-divided in a very pleasing manner by placing an informal carpet bed with a clump of shrubs. A tree may be so placed as to relieve a cement concrete wall of its monotony. In an informal garden, a few simple, bold and graceful curves are to be preferred to many undulating sharp curves.

View from the house. The view from the house is an important consideration and, therefore, the garden should be planned in such a manner that the house merges with the garden and also commands a beautiful view from its main living rooms. A focal point

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with a merging foreground makes the garden attractive. A shapely tree or shrub, evergreen or flowering, makes a choice point. Some prefer a fountain with a statue, or sundial with a seat, for a focal point. I would, however, prefer a plant material.

Variety and surprise. It is easier to introduce variety and surprise in the garden which has natural features such as slopes, water course, boulders, etc. Advantage of contours and existing trees may be taken as far as possible. South and west sides of these slopes can be converted into an attractive rockery while north and east side may be assigned to evergreen shrubs, fernery, orchids, etc.

Do not overcrowd. An important maxim is 'Do not overcrowd'. When the choice is whether 'to plant' or 'not to plant', it is better 'not to plant' or 'replace a plant'. A garden overcrowded with a number of trees and shrubs is more like a botanical garden than a home garden. It is interesting to note that a garden which looks overcrowded at night does not look so in the daylight. Therefore, the lesson that dark colours have the effect of crowding together.

In big compounds, however, the trees may be used as a backdrop to the house or like a frame of a picture. Trees like *Magnolia grandiflora*, if planted, should be away from the house as a focal point in the lawn or towards the compound wall. The trees can be effectively used as wind barriers. I saw the result at 'Lumpyngnad' in Shillong. It had tall trees of *Betula alnoides* (birch), *Cupressus torulosa*, flowering cherries, *Grewia*, *Livistona* and cinnamon on the north side and the result was no frost in our lawn when all others had.

Colour scheme. In the colour wheel, there are three primary colours: red, blue and yellow. In between them are three secondary colours: violet, green and orange, arranged in the order in which the colours appear in the rainbow 'VIBGYOR' (minus I for indigo). There are thus six main colours. Red, orange and yellow are warm colours and the other three main colours — violet, blue and green — are cool colours. Black and white and similarly combination of black and white producing shades of grey are neutral colours. In between these six main colours are the subsidiary colours like blue-green between blue and green and orange-red between orange and red. The colours opposite to each other make a bright pleasing contrast. The contrast may be between opposite main colours like yellow and violet of traditional South Indian sarees, or red and green of bright scarlet flowers and dark green foliage of *Salvia splendens* or *Rhododendron arboreum*. The contrast may also be between opposite colours like blue-violet and orange-red as in *Delphinium* and *Eschscholzia* or in Canterbury bells and wall flower or in the blue of *Myosotis* (Forget-me-not) and *Polianthes*. A very harmonious effect can be produced by using shades of two adjoining colours like orange and orange-yellow as in the shades of *Nasturtium* and *Dimorphotheca*. Neutral colours can be successfully inserted between any adjoining or contrasting colours on the wheel.

Fragrance. Fragrance in the garden is as essential as colour. In selecting shrubs, flowers and climbers, preference may be given to growing for scent like *Acacia alata*, *Cassia artemisioides*, champak, *Francisea latifolia*, *Gardenia*, henna (*Lawsonia alba*),

Lonicera nitida (honeysuckle), jasmine, lavender, *Magnolia*, mignonette, night queen (*Cestrum nocturnum*), *Plumeria*, roses, stock, sweet alyssum, and tuberose, etc. A *kewda* (*Pandanus odoratissimus*) shrub could be added for fragrance as well as beauty of its flowers and fruits.

Spacing. A gardener too often overlooks the size the plant will attain on maturity. Its slender form when young may be misleading. The distance between the plants should be such that the leaves and branches of one do not shade those of the others on maturity.

Space for vegetables and fruits. The vegetables would need 2-3 crops to be raised on a plot, and the kitchen garden thus needs much labour. Hired labour is undependable and expensive. A comparatively small portion of the garden needs to be reserved for kitchen purposes unless adequate and dependable labour is available. 300 m² is considered sufficient for providing a family of four with vegetables for about nine months. Fruits, on the other hand, once planted carefully, may need less labour, but they block the area for long period with no scope for introducing frequent changes. One-tenth of an acre is reported to be sufficient to provide fruits at the rate of 1 kg per day for a family of 4-5 members (total estimated yield being 400 kg). A balance between the kitchen and fruit garden has thus to be introduced.

It may be a good idea to reserve about one-third of the garden for permanent features such as lawns, hedges, paths and garden accessories. One-third may be for flower garden which may include annuals, perennials, bulbs, shrubs, rockery, water garden, etc., and the remaining one-third may be for vegetables and fruits together. This combination may, however, be changed according to the personal preferences and natural features.

Water supply and garden accessories. It is important to be sure about the source of water supply. The availability of help, cost of making and maintaining it will also determine the garden plan. Garden accessories, such as compost pit, and a garden storehouse for storing of seeds, bulbs and implements, is an item which deserves the highest priority in planning, but gets most neglected. A water well or pump or any other source of water supply should also be planned at this stage.

Choice of plants. In making a choice of the plants, greater emphasis should be on the plants suited to the locality, though experiments with exotic plants would be interesting. The altitude of the place, whether plains or hills, high or low and its location whether North India or South India would also determine the type of flowers, fruits or vegetables which can be suitably grown. The selection of plants may also be done according to the position of the land available, i.e., whether it is sunny, semi-shady or shady and whether it is on the north or south wall; how much is under trees or hedges.

In choosing the plants, you may not like to miss a plant which you fancy — as you cherish the sweet memories associated with it or for which you have nourished a religious sentiment as the *tulsi* plant (*Ocimum sanctum*). The *tulsi* is not a mere plant, it is a symbol of religion of the Hindu community. It finds place in every social place, in a thatched hut, in a merchant's shop, in a palace, in a multi-storeyed flat, in India or

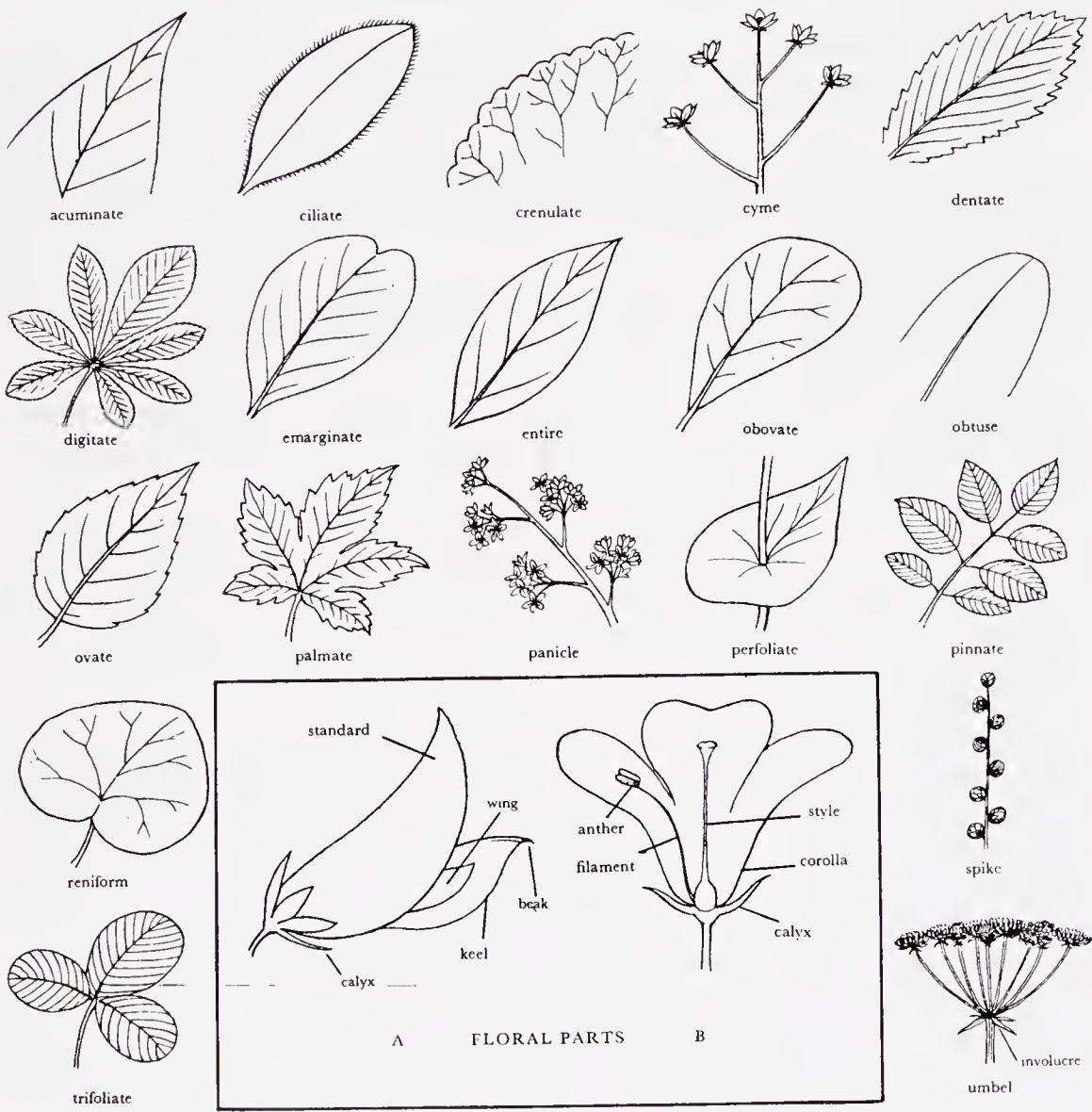


Fig. 1. The shapes of leaves and floral parts

abroad.

The choice of plants also depends on the shapes and texture of leaves. A plant with narrow pointed leaves as a croton may be balanced by a plant with round leaves like *Pelargonium* or a lacy one like *Asparagus plumosus* may be balanced by a leathery broad-leaved one like a rubber plant (*Ficus elastica*). The line drawings as reproduced in Fig. 1 are helpful in such a search.

Arches and pergolas. Arches and pergolas look natural in combination with certain other features such as hedges, screens, walls, etc. An arch by itself in the middle of a lawn would look isolated and unnatural but in continuity of a hedge, dividing the lawn into two sections or separating the lawn from the kitchen garden it would be natural.

South wall aspect. The south wall does not mean the wall which is on the south side, but the inside of which faces the south. For example, the inside of the wall on the north will face the south while the inside of the wall on the south will face the north.

Hill features. In the hills, a wall facing south or south-east should not be used in making paths or planting shrubs. It should be reserved for the widest possible herbaceous border. The fruit trees should not be planted on the east or south-east walls. The morning sun may cause the frost-covered fruits to crack. On the south or south-west side the warming is gradual and, therefore, fruiting is better.

Situation. The situation of the plot is also important. On the hill top, it is likely to be wind-swept but comparatively free of frost. The valley may have pockets of frost. On the sea side, there may be problems of salty atmospheres. Protection from cold or hot winds has to be provided by hedges and trees.

Landscaping. It needs an expert to do landscaping successfully on a big scale. But once an eye for colour, harmony and balance has been developed, a successful home gardener can attempt landscaping also.

Garden features. A garden is more exciting if it contains certain changing features besides its permanent features. It may have some or all of the following features depending on its size, contours, location and, above all, the choice of the gardener: (i) fencing, (ii) lawn and hedges, (iii) garden paths, (iv) flowering shrubs, evergreens and small trees, (v) house plants and pot plants, (vi) rock garden, (vii) terrace garden, (viii) water garden, (ix) annual and perennial flowers, (x) vegetable garden, (xi) fruit garden, (xii) greenhouse and hot house, and (xiii) garden accessories.

To all these may be added a very unconventional, exclusive and personal wild garden where the plants may be allowed to grow as if in a jungle. But do not get so carried away as to let it become the breeding ground of snakes.

The garden is yours and plant it as you would like it, after hearing all the advice offered to you.

3

GARDEN OPERATIONS

THE important garden operations can be grouped in seven 'P's, as follows :

- (a) Procurement of plant material
- (b) Preparation of soil
- (c) Plant propagation
- (d) Planting
- (e) Plant watering and feeding
- (f) Pruning
- (g) Plant after-care

PROCUREMENT OF PLANT MATERIAL

Plant material may be in the form of seeds or plants according to the plan, it is better to make the selection early and collect the catalogues at least six months in advance. Some of the institutions, like the Indian Agricultural Research Institute, New Delhi, require booking of orders for roses and bougainvilleas about six to eight months in advance, when new plants are being raised, e.g. the orders for roses are taken in January-February for supply in September-October and for bougainvilleas orders in February-March for supply in July-August.

For small gardens, it is not necessary always to buy the latest varieties because these are often very costly. A gardener, unless desirous of competing in a show, can afford to wait for a couple of years when the price comes down.

The source of supply must be the most reliable one. Economy at the expense of quality of plant material is a very false economy. After all the labour and patient waiting, it is heart rending to see indifferent blooms or fruits. There should be no compromise with quality. Within the allotted budget, less types of plants and less of each type may be provided as further multiplication is easy. The experience of other gardeners is a good guide in this matter. Advice given by professional bodies regarding disease-resistant varieties may be taken into consideration in selecting the material.

Normally, the orders may be placed at least six weeks in advance to allow for postal delays or non-availability from a particular supplier. If the plant material is vegetative, i.e., in the form of plants, the site where it will be put immediately on arrival may be kept ready in advance. If weather on arrival is not suitable, i.e., it is too rainy or too chilly, or the ground is wet, soggy or frost bitten, it is better to keep the material after unpacking in a sheltered place, with roots intact and covered with soil. The original packing, if with the earth ball, may be retained intact with a moist gunny bag around it.

PREPARATION OF SOIL

This includes a number of operations, such as trenching, digging, manuring, levelling, surfacing, ridging or making beds.

The function of good soil is to supply nutrition to the plant, retain moisture in it and hold the roots firmly. The essentials of good soil, therefore, are that it should be well-drained, well-dug and well-enriched.

Drainage. All plants need good drainage except, of course, water plants whose medium of growth is water, and some of the waterside plants which grow in marshy soil conditions. Sometimes, a mistake is made in cultivation of moisture-loving plants and it is thought that they should have water standing around their roots. Some plants like *Hedychium* or *Kniphofia* resent 'wet feet' and the result is disastrous if they are subjected to this. Under such conditions, lilies will just rot. Even in the case of orchids, which like high humidity, water-logging or frequent watering will cause rotting of the plant. Ferns, which hate drought, would however not thrive if the soil is not well-drained.

Drainage will depend on the degree of water accumulation in the soil. In case of excessive moisture, drain pipes may have to be laid in the garden. Normally, the requirements of a small garden can be met by one or more of the following:

- (a) Dig a drain around or by the side of a garden. The water may be then drained into an existing drain.
- (b) Raise the bed by about 7-8 cm (3 in.) above the ground. This is generally practised in places with high rainfall.
- (c) Add boulders, gravel, crocks, leaves, etc., at the base of the trench prepared for planting.
- (d) Add sand and leaf mould in the soil.
- (e) In case of pots, close the bottom hole with a crock and put smaller crocks and stones. Spread fibrous material on the bottom layer of crocks to prevent choking of the bottom hole.

Digging and trenching. 'Good digging' makes the soil porous and removes obstacles to the plant roots. All hard objects such as boulders, stones, roots of trees, etc. and weeds, as far as possible, should be removed after digging. Small stones in the soil may be retained as they help in drainage and also keep the root system cool. The roots of the plants are not obstructed by them because they can bypass them. In the case of seedbeds, of course, sieving of soil is advised as the root system of seedlings is delicate.

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The important point to be borne in mind in digging is that top 20-25 cm (8-10 in.) soil which is the richest and the best, should remain at the top. Digging may be simple digging or trenching. In simple

digging, the soil is dug with a spade, turning it inside out, without removing it from the bed.

In trenching, the width of the bed is usually divided into strips of 45-60 cm ($1\frac{1}{2}$ -2 ft). The depth to which soil is dug depends on the requirement of the plant. The soil is dug first up to one spit. The top soil of 20-25 cm is removed outside the bed. For two spit digging, the bed is then further dug up to another spit. All big stones, metal pieces, hard fibres, etc., are removed. Earth lumps are broken. At the bottom of the second spit 5-7 cm (2-3 in.) layer of small stones and gravel, grass, leaves, etc., is added to improve drainage. It is manured and mixed thoroughly with the soil. The second trench is then dug one spit deep and top-soil of this trench is transferred to the first trench. Second spit depth is dug and prepared as in the first trench. The top-soil of the first trench is transferred to this trench. The digging is then complete. If the bed is divided into more than two strips, the process is repeated further with the modification that the top-soil of the first strip is transferred to the last strip.

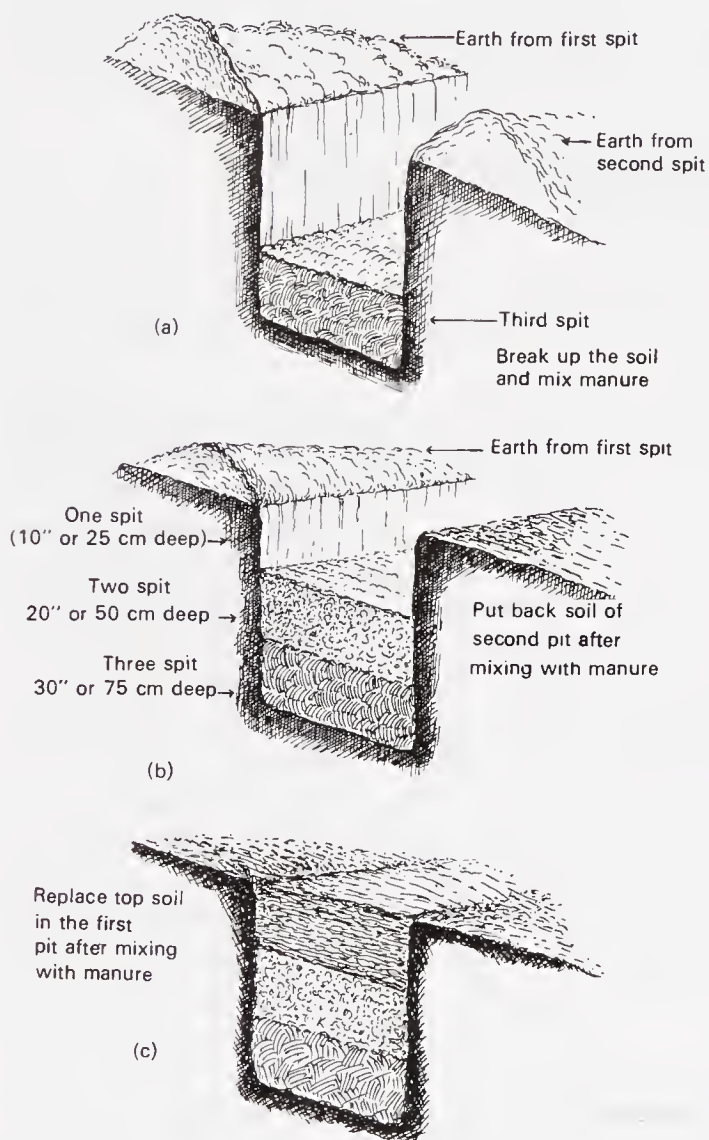


Fig. 2. Trenching: A sectional diagram
 (a) One spit 25 cm (10") deep
 (b) Two spits 2 x 25 cm (2 x 10") deep
 (c) Three spits 3 x 25 cm (3 x 10") deep

After the soil has been prepared, it should be levelled with a wooden beam. All surface-rooted plants benefit by

firming the soil with a light roller. The beds may be higher by 5-8 cm (2-3 in.) than the ground level in places with heavy rainfall. The beds may have narrow raised borders of the same height to conserve water in hot and dry places. The root crops do best in ridges and, therefore, the beds may be given the shape of ridges of required depth and width.

Soil enrichment. 'Well-enriched' means the soil rich enough for the growth of plant and able to retain moisture. The requirement of food of each plant differs. The soil mixture has, therefore, to vary with the variety. *Nasturtium* grows well on poor soil; given very rich soil, it produces a mass of leaves with very few flowers. Some others also may need very little of manure, like cacti and the succulents, and would be more happy with leaf mould, sand and wood-ash.

Soil may be enriched by adding organic and inorganic manures. Some other components like sand, lime and cement mortar pieces are necessary for certain plants. Organic manure is a manure made from wastes of plants or animals, while an inorganic manure is made chemically and is, therefore, also known as chemical fertilizer. Organic manure is sufficient for ordinary household purposes but is required in large quantities and is not readily available in big cities. It needs to be supplemented by inorganic manure which is available in handy packets either as separate chemical fertilizers or as a 'mix', with different fertilizers mixed to meet the requirement of different categories of plants.

Organic manures are slow acting, they keep the soil porous, improve its water-retention capacity, help in assimilation of inorganic manures, check micronutrient deficiencies which may be caused by excessive application of inorganic manure, and also effect long range improvement in the soil. There is no danger of over-feeding with organic manure as the plant takes the quantity required by it. This danger arises with the inorganic manures which are quick in action, are easily soluble in water and act as stimulants. In the long run, unless supplemented by organic manures, they adversely affect the soil texture as well as the fertility of the soil. They should, therefore, be given only in combination with organic manures. In applying inorganic manures, care should be taken that the fertilizer does not come in direct contact with the collar or the roots of the plant as it has a burning effect.

Farmyard manure, leaf mould and compost should be used only when well decayed and fully decomposed. The material should be soft and crumble well in hand.

It has been recommended by some gardeners to expose surface roots of shrubs and trees including fruit trees for a week before manuring the plant. The utility of this practice has not been scientifically established.

Besides organic and inorganic manures, there are materials like sand, cement mortar and lime which serve as aids to plant growth as follows:

SAND. It has no nutritional value but makes the soil porous. It is essential where soil is heavy or where the plant requirement makes such a demand as in the case of cacti and succulents. If kept continuously wet, it is an excellent medium for rooting of cuttings.

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CEMENT MORTAR. Old cement mortar pieces broken into small bits of 1.5-2.5 cm (1/2-1 in.) are added to the soil mixture, to improve drainage and also to provide lime. Roots of ferns like to cling to the cement mortar pieces. I found it useful in all cacti, in succulents and ground orchids also.

LIME. Lime is required for the soils which are deficient in it, also for the special requirement of certain plants. It improves soil texture, moisture-retention capacity and helps in assimilation of humus. It also acts as a mild preventive against fungus and insect pests. Under alkaline conditions certain elements like manganese, boron and zinc become unavailable to plants. Under acid conditions phosphorus, magnesium and calcium are not available. In acid soils, addition of lime at the rate of 250 g/m² (8 oz/yd²) is helpful. In case of pots, one tablespoonful in a pot of 20-30 cm (8-12 in.) diameter and one-half tablespoonful for smaller pots is sufficient. Liming may normally be done once in three years in the plains in a garden soil, once in two years in the hills with heavy rain. There are certain plants like *Rhododendron* and *Azalea* which are known as lime-haters. There are also other plants like lily which, with a few exceptions, also like slightly acid soils. Therefore, plant requirement should be taken into consideration before adding lime. Lime should not be added in alkaline soils with high pH. It is advisable not to apply lime and cowdung simultaneously. Lime may be followed by cowdung after an interval of 15 days. One of the simple methods for testing the acidity of soil is to insert litmus paper in soil. If it changes its colour to red, the soil is acidic; if it changes its colour to blue, it is alkaline; if the change is into any other colour, the soil is neutral.

Organic manures. Organic manure is available in the following forms:

- (a) Farmyard manure
- (b) Leaf mould
- (c) Compost
- (d) Sludge, i.e. treated night-soil
- (e) Bonemeal
- (f) Wood-ash
- (g) Oil-cake
- (h) Soot and charcoal-dust
- (i) Green manure
- (j) Liquid manure (as described in this chapter under Plant Watering and Feeding)

Farmyard manure may include manure from cattle, sheep, horses, pigs and birds. But in India, generally cattle-dung manure is commercially available. In exceptional cases, where a gardener raises his birds or animals he would be able to use other animal manure. Bird manure is very strong and it is advisable to add to it the compost rather than apply direct. In this book, therefore, the word 'farmyard manure' has been used in this context. Farmyard manure is a complete manure and can meet the full requirements of a plant. An average requirement is about 10 kg/m² of area per annum. This may be modified according to specific needs. It contains about 4 per cent nitrogen.

Do not keep farmyard manure exposed to sun or rain as the ammonia gas would escape. It is better to leave it in the pit where compost is made and take out at a time only the quantity required. If the manure is acquired from outside, a pit can be dug to keep it. It may be covered with a thin layer of earth.

Leaf mould is a well-decayed mixture of leaves, grass, soft wood, lawn mowings and any other plant material. It contains humus which promotes plant growth, improve soil texture and increases its moisture-retention capacity. It helps in assimilation of other plant nutrients. In combination with sand, it is an excellent medium for potting of cuttings. It is vital for orchids and ferns. It is almost impossible to get it commercially in India. It can either be collected from the forests or made in your garden. Average requirement per annum is 5 kg/m² area. This may be modified according to soil condition and specific requirement of plants.

Compost is a well-decayed mixture with soil of leaves, lawn mowings, wood, household vegetable and fruit refuse, wood-ash or any other material which can easily decay. Woody branches of trees, fibrous material, thorny bushes, which are tough to decay should be burnt first and only their ash added to the compost pit. Any farmyard manure if available, may also be added to this pit. It can be applied 0 10-15 kg/m² area.

Sludge, i.e. treated night-soil is considered to be inferior to the farmyard manure in its manurial value, but serves as a substitute in case of non-availability of farmyard manure.

Bonemeal is a slow acting organic manure. It is generally added at the rate of 100-150 g/m² (4 oz/yd²) mixed in soil mixture or given as a top-dressing. In order that this nutrient is available to the plant immediately after planting, it should be added to the soil about two months in advance.

Wood-ash contains potash and is good for all root vegetables. It also improves the colour of flowers and fruits and the setting and flavour of fruits.

Oil-cake which is a residue left after making oil is usually given as liquid manure if fresh cowdung is not available. As liquid manure, it needs to be fermented for longer periods than fresh cowdung manure. *Neem*-cake is said to ward off attack of insects including white ants and pests. It is commonly used in New Delhi for grapes cultivation.

Soot is not used in this country as chimneys are not lighted in the houses except in the hills. Even in the hills, soot is not used. It is said that soot water brightens colour of foliage and flowers and acts as a preventive against larvae of insects, snails and slugs. It is added at the rate of 100-150 g/m² (4-6 oz/yd²).

Charcoal-dust is used very successfully in the country and also acts as a preventive against larvae of insects, snails, etc.; improves moisture-retention capacity and the porosity of the soil. The orchids relish it. It may also be added at the rate of 100-150 g/m²(4-6 oz/yd²).

Green-manuring means the growing of a crop in the soil and digging it into the soil while it is green. A good crop of suitable plant material such as sunnhemp (*Crotalaria juncea*), dhaincha (*Sesbania cannabina*), soybean or any other quick-growing

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leguminous crop like cowpea (*Vigna catjang*) or *mati kalai* (*Phaseolus mungo*) sown in rainy season, harvested and dug into the soil will rejuvenate the sick soil. It can also be used if compost, leaf mould or farmyard manure is not available, as sometimes happens in the cities. As part of the rotation of vegetables in the kitchen garden, it is also a good practice to grow on each plot a crop of green manure once in three years. I saw in the hills that around the base of the fruit trees a few plants of soybean were often grown for green-manuring.

Inorganic manures. If healthy plants or seeds are selected and grown well and there is enough organic manure in a garden, there is normally no need for inorganic manures. For some quick or showy result or in the absence of adequate organic manure, inorganic manure may be added. I have normally avoided the use of inorganic manures.

The inorganic manures or the chemical fertilizers, when applied, may be mixed in the soil at the time of preparation of the beds or pots or may be given after the plant is well established. If the fertilizer is applied after the plant is established, a good watering should be given immediately after application. It is better to overwater the plant for a week after application than to underwater it which may have the effect of burning it. An inorganic manure can also be applied in liquid form as described in this chapter under 'plant watering and feeding'. The primary chemical fertilizers used for small gardens are nitrogenous, phosphatic and potassic. There are also other fertilizers to meet the secondary and micronutrient deficiencies. They are also available as ready mixes. Indian soils are generally deficient in nitrogen, while potash is generally available in sufficient quantity. The fertilizers have different reaction and different composition. Therefore, it is advisable to follow the instructions regarding their use. One of the useful ready mixes is Ralimeal which besides the inorganic fertilizers includes bonemeal, blood-meal and hoof- and horn-meal.

Nitrogenous fertilizer helps in good growth of the plant, promotes green foliage and a sturdy bush. It improves the vigour of the plant. Its deficiency can be noticed if a plant is not growing well. The leaves are small or are pale green in colour. Sometimes the leaves turn yellow but do not drop off. Dose is 30-60 g/m² (1-2 oz/yd²) or one tablespoonful for a pot of 25-30 cm (10-12 in.). It is better to give it in two or three equal doses at fortnightly intervals. Some common nitrogenous fertilizers are ammonium sulphate, nitrate of soda, calcium nitrate, urea and ammonium nitrate. Ammonium sulphate is acidic and is not safe in soils deficient in lime unless supplemented by lime. It contains about 20 per cent nitrogen and is greyish-white in colour. Nitrate of soda is alkaline in reaction and is not suitable for alkali soils. It contains about 15 per cent nitrogen. Urea has 46.6 per cent nitrogen and is acidic. Its granules are clear white like sugar. It is a very quick acting fertilizer. It is effective within a maximum period of about 3 days.

Phosphorus fertilizer helps in production of more and better flowers and fruits. In vegetables, it is helpful for those where the 'head' is taken like cabbages and cauliflowers. Dose: 60 g/m² (2 oz/yd²). Its deficiency symptoms are dropping of mature

foliage and dropping of premature fruit or flowers, weak stems, etc. This fertilizer may be obtained from superphosphate or basic slag. Superphosphate is of greenish-grey colour and is in two grades of 13 to 40 per cent phosphoric acid. Basic slag is blackish grey and has 8 to 18 per cent phosphoric acid. Basic slag is comparatively slow acting and is recommended for acid soils. It is slow acting as compared to the nitrogenous or potassic fertilizers and may take about 4 weeks for its effect. It is mainly applied as a basal dose.

Potassic fertilizer takes more time for effect than the nitrogenous fertilizer but less than the phosphatic fertilizers. An interval of one week may be required for its full effect. It is essential for proper assimilation of nutrition by the plants and helps in the growth of root vegetables, bulbous plants and fruits. It also helps in better setting and better flavour of fruits, as mentioned in the case of wood-ash. Its dose is 20 g/m² (3/4 oz/yd²). Its deficiency symptoms are certain patches in leaves or fruits, e.g., greening or yellowing in tomato, brown patches around leaf margins in roses. This fertilizer may be obtained from muriate of potash (potassium chloride) or potassium sulphate. Both these fertilizers contain about 50 per cent of potash.

Besides the three primary nutrients mentioned above, the soils due to over-cultivation or their inferior composition may sometimes show secondary nutrient and micronutrient deficiencies. The secondary nutrients are calcium, iron and magnesium. The important micronutrients are zinc, boron, and manganese. These deficiencies are seldom noticeable in home gardens which are comparatively well-cultivated. The deficiency can be diagnosed and treated by experts only. If facilities for soil testing exist in the area, it is useful to get the garden soil tested once in a while.

PLANT PROPAGATION

One of the secrets of gardening lies in mastering the technique of plant propagation. An important principle in plant propagation is that all plants do better on new roots. There is, therefore, a cycle in the life of every plant when it becomes necessary to replace it by a new one.

The methods of propagation other than those from seed are called vegetative. The important methods of plant propagation for small home gardens are as follows:

1. Seed
2. Vegetative
 - (i) cuttings, including leaf and root cuttings;
 - (ii) bulbs, corms, tubers, rhizomes, etc. (See Chapter 8);
 - (iii) root division, including suckers and runners;
 - (iv) layering;
 - (v) budding; and
 - (vi) grafting.

Propagation from seed. Almost all plants can be raised from seed and it is the most important tool in nature for propagation. In home gardens, however, raising from seed is

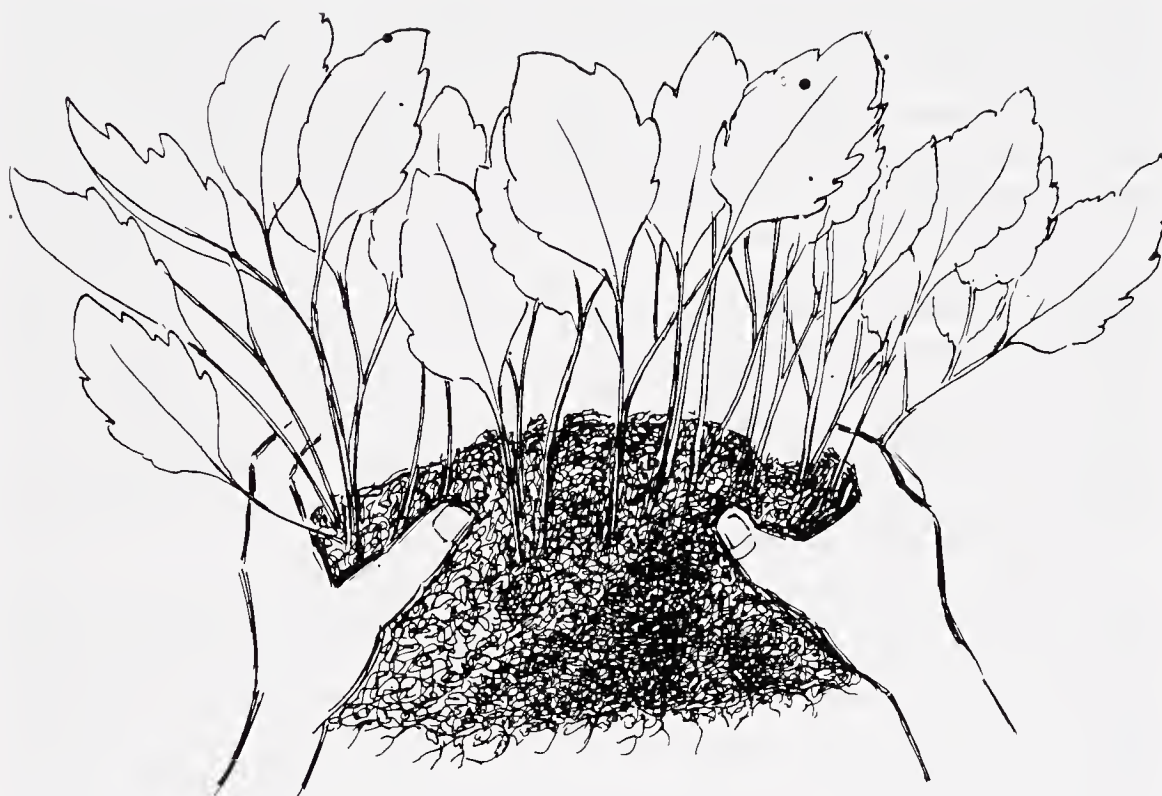


Fig. 3. Root division

not advocated for all plants. Due to cross pollination, in vegetatively propagated species like most fruit trees, ornamental plants and a few vegetables like potato, sweet potato, *parwal* (pointed gourd), plants are not multiplied from seeds as their progeny does not come true to type. A few fruit trees like papaya, annual seasonal flowers and most vegetables are grown from seeds. Seed propagation is also practised by plant breeders to evolve new varieties in those plants which are generally multiplied vegetatively such as roses, potato, bougainvillea, hibiscus, crotons, etc.

Some plants are difficult to raise from seed like gladiolus. Some plants, raised from seed take longer time to grow than from suckers, layers, buds or grafts, e.g. varieties of fruit trees. Generally, more care is required for raising from seed than from the vegetative processes of root division.

Seeds may be purchased or collected from your garden. If it is purchased, it must be from a very reliable source, as mentioned earlier. If seeds are collected in your garden, they should be of the best plant which did not suffer from any serious disease. If the whole crop in the garden had been affected by any disease, it is better to buy fresh seeds. Drastic roguing, i.e. removal of all inferior and diseased plants in the garden should be done. Roguing must be done as soon as the first sign of disease or the first inferior flower appears. By this process, seeds of annuals can be improved considerably. It is true that

the beds look patchy and, at times, ugly due to roguing of such plants. But there can be no compromise if the seed is to be raised in your garden. Just as a bad coin drives out a good coin, bad seed always drives out good seed.

It is very difficult in small gardens to collect seeds of different colours of a variety if they are grown together. Therefore, if you propose to have seeds of one colour, all others grown nearby should be discarded and only the plants with flowers of the colour selected should be allowed to seed. I experienced some difficulty in collecting the seed of phlox in selected colours. Though all the plants of certain colours were removed from my garden, the seed continued to give a large number of plants of these colours. The key to the puzzle lay in the flower plants in my neighbour's garden. The cross-pollination may be in an area extending beyond your garden. In such cases, it is better to purchase new seeds every year. In stocks, the double flowers are sterile and do not set seeds. The seed is collected from the plants having single flowers which later give double and single flowers.

A question arises whether seeds should be collected at the early or later period of the growth of the plant. I consider it a good policy to collect the seeds of the earliest flowers as these blooms are the biggest. But sometimes there may be rains during the early period. In such a case, it is advisable to collect the seeds of the later period. It may be argued that if a plant is allowed to seed early, it may not bloom over a long period. The requirement of seed for a small garden is very limited and can be met by a few blooms allowed to seed. It should not, therefore, affect the flowering capacity of the plants as a whole. In some cases the seed has to be collected three or four times as it does not mature simultaneously. It is better to label the plants whose seed is proposed to be collected. Once blooming is over, it is difficult to distinguish the superior plants from the others.

Seeds should preferably be collected on a dry day with no strong wind. They are likely to be blown off on a windy day. Collected on a wet day, they do not dry properly and are likely to get mouldy.

It is advisable to dry seed in a warm and dry place. A place which is too hot, sunny or moist is not suitable. A protected corner which gets morning sunshine is to be preferred. After sifting the seed and plant material and removing dry leaves, shoots, etc., seeds may be stored in a dry bottle with tight lid and labelled. Storage of bulbs has been covered under Chapter 8.

Preparation of seedbeds. Plants may be raised from seed sown in the ground where it is to bloom, i.e. *in situ*, or may be raised from seed grown in boxes or seedbeds and transplanted to other places. Root crops and legumes and annuals like poppies and nasturtium, do not like transplanting. Vegetables of the cabbage family, a few root or stem vegetables like onion, celery, leek and most of the annuals do better with transplanting. There are some others which can thrive under both conditions but for large scale cultivation do better when sown directly in the ground, like shallow-rooted vegetables such as turnips, beet, and knol kohl.

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Seeds purchased from a reliable source would generally cause no problem in germination. But seedbed should be carefully selected and prepared. The function of a seedbed is to promote good germination and not to provide for the full growth of the plants. Therefore, soil should not be rich. Fertilizers and fresh manure should not be used. Seeds or tender seedlings are very susceptible to heavy rain, scorching heat or frost. Therefore, a well protected place, such as under the projection of a roof or a balcony which gets morning sun, is the best site.

Guiding rules for seed sowing. Some guiding rules for sowing of seed are given below:

1. Instead of broadcasting seeds, they may be sown in lines. There is less wastage of seeds, it enables uniform spacing and facilitates intercultural operations.

2. Fine seed may be mixed with fine sand for more even sowing. The total mixture may be divided into the same number of heaps as the number of drills and then distributed evenly.

3. Do not sow very deep. Twice the thickness of a seed is a good general maxim. Dust-like seeds of gloxinia, after mixing with fine sand, should not be covered with soil and should be just spread on the seedbed. In case of very fine seeds, it is better to sieve the soil. Spread the soil, after sieving, about one-fifth cm (one-tenth in.).

4. Sow thinly, as thick sowing is wasteful, requires extra labour in thinning and encourages the 'damping off' disease.

5. Use a watering can with a very fine nose for watering. Instead of copious watering, it should be just enough to keep the soil moist up to the seed level. Soil watered a few hours before sowing, which is just moist and not wet, provides favourable conditions for germination. Covering seeds after sowing with a damp sack is a good practice for conserving moisture but it must be removed immediately after germination begins.

6. Some of the seeds sown *in situ*, as of beans, peas, and sweet corn, are tempting to the birds and rats. They may be covered with straw, about 2.5 cm (1 in.) thick. Remove straw after sprouting. Chicken wire covering on the top and the sides with wooden frame is very useful. Immediately after sprouting, the tender seedlings would need further protection from damage by birds and rats. Use of small bushy sticks, arranged criss-cross is helpful. Black thread, woven thick over the area to be protected, is reported to be a good prevention.

7. Use of sterilized compost for seed propagation is likely to be very helpful. But in India, this is not available and if someone specially prepares or procures it, its procurement would be exorbitant both in labour and cost.

8. Seedlings are very susceptible to a disease called 'damping off'. It is promoted by excessive moisture, high humidity in the atmosphere, high temperature, shady condition and crowding of seedlings. Seedlings should be thinned immediately after germination to allow light and air through them which prevents as well as checks the disease.

9. For transplanting seedlings to the place where they will finally grow, they should have about two or three pairs of true leaves. They may be protected from direct sunshine and rain by a sirki mattress known as a 'Hogla' arranged in an angular manner like a roof.

10. When seeds are sown *in situ*, beds should be prepared in accordance with the requirements of the plants. If the plants are growing too thick, they should be thinned out in batches as in carrots or turnips or in one lot as in flowers.

11. Seed sown on its edge or growing point upward germinates quicker as compared to the seed sown with its growing edge downwards.

Colour identification in seedlings. In some of the plants, difference between light and dark shades can be identified from the foliage as soon as two or three pairs of true leaves have come out. In the same variety, the plants, with flowers in shades of white, yellow and light pink would generally have light-coloured foliage while those in the shades of red, maroon and magenta have dark foliage. This distinction is more specific in the annuals. It is not so marked in the bulbous plants though some of the bulbs show this difference. The gladiolus corms show the difference but not the dahlia tubers.

Vegetative propagation. Vegetative propagation includes raising of plants by cuttings, root division, layering, budding, grafting, etc.

Cuttings. A cutting is a vegetative portion of a plant used for propagation. It may be a stem, root or leaf.

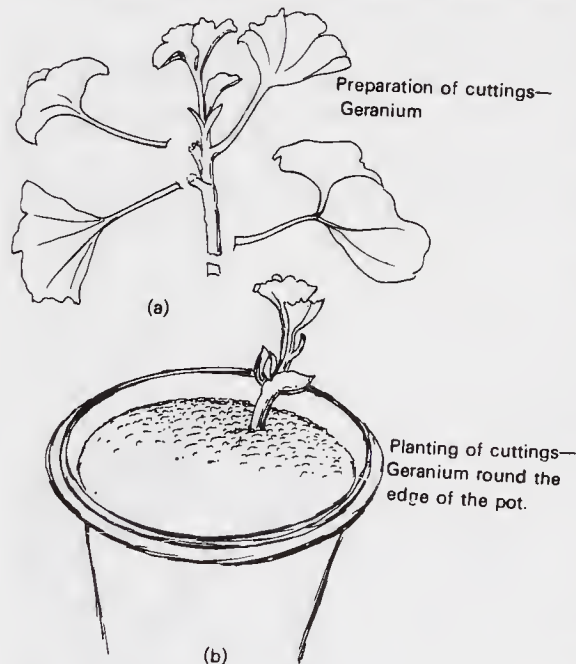


Fig. 4. (a) Preparation of cuttings (Geranium), (b) Planting of cuttings (Geranium) round the edge of the pot

Generally, the cuttings are made from the stem or branch of a plant but in some cases, a single leaf serves as a cutting. Rex Begonia, gloxinia, *Bryophyllum*, peperomia and African violets are some of the fine examples of plants grown from leaf cutting. The finest of all these, I think, is the Rex Begonia.

For selecting a vegetative portion of a plant for use as a cutting, it is better to study its behaviour of growth, i.e. to understand whether it forms fresh growth on new wood or old wood; whether it grows from a leaf or a stem. If it forms fresh growth on old wood, hard wood cuttings would be required; if it forms fresh growth on new wood, soft wood cuttings would be required. A hard wood cutting is a mature cutting, taken when the plant is dormant, i.e. when the plant is about to complete its period of rest after

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flowering and before it is ready to commence its new growth. A soft wood cutting is taken when a plant is actively developing, i.e. immediately after flowering. In either case, the cutting should be mature and should be taken when the sap is rising. It should not be too woody or fibrous.

For taking a cutting, a cut should be made just below a leaf joint or node or leaf junction. In case of cutting from a leaf junction, a little portion of skin or 'heel' of the parent plant taken with the cutting gives better results. Such a cutting is called 'heel' cutting. Others are called 'nodal' cuttings. Heel cuttings can be taken by giving a gentle sideward or downward pull to the shoot. Cuttings of dahlia, *Geranium*, petunia, *Chrysanthemum*, carnation, etc. can be taken in this manner. The cut at the base of a cutting should be just below the leaf joint.

In most plants, a shoot which has already flowered is useless as a cutting but there are exceptions, like bougainvillea. A cutting which is hollow in the middle of a stem will not root, as in *Petunia* but it roots well if the cutting is made with a heel or the cut is made just below the node. It is recommended by some that shoots growing on the shady side of the plant or from a parent growing in light shade, are better than those growing in the sunshine as more starch content in the cutting in shade is likely to promote quicker root-growth. But I doubt if this has been scientifically established. Side shoots springing from the base, preferably cut off below ground level, are better. A cutting should be taken from a healthy, sturdy, disease-free plant. It should preferably be taken in the early morning or late afternoon as more sap rises in the plant at that time.

Short-jointed cuttings, in which leaf joints or nodes are at a short distance, are better than the cuttings in which the distance between the leaf joints is more and the growth is lean and straggling.

The size of the cutting may depend on the kind of plant. Generally, a cutting with 3-5 healthy eyes is a good size and its length may be about 20-30 cm (8-12 in.). Cuttings

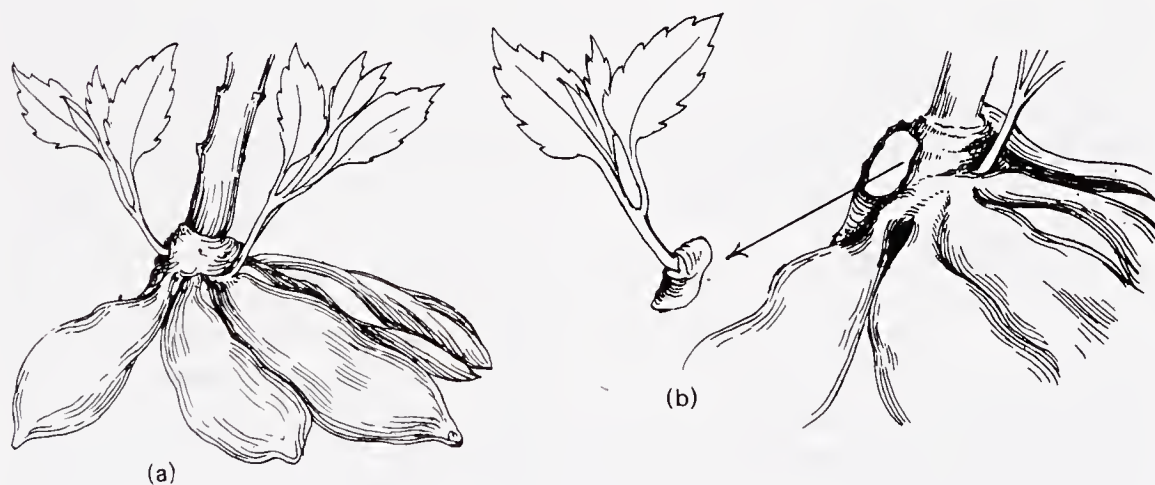


Fig. 5. Heel cuttings as of dahlia tubers

from herbaceous plants can be shorter up to 15 cm (6 in.). If the cutting is too long, it should be shortened from the tip and not the base as it grows better near the base.

Normally a cutting should be planted immediately after its removal from the parent. In case of certain plants which rot quickly, like succulents and the pineapple, it is better to let the cutting remain in a dry shady place for some time to form a callus before planting. In case of a plant which exudes milky juice, like *Poinsettia*, it is better to sprinkle wood-ash or, in its absence, ordinary soil immediately after taking the cutting. Soil for the cuttings, which are to be transplanted later, should not be very rich. Very successful cuttings are made in sand, kept moist. The danger is that under Indian conditions sand has a tendency to dry up too quickly. Therefore, sand and leaf-mould added in equal proportions is an excellent mixture. The soil for cuttings planted *in situ* will depend on the requirement of the plant.

About one-third of the cutting may be inserted in the soil at a slight angle to the vertical. The rooting of such cuttings is quicker than those planted vertically. A pinch of sand added at the base of the cutting prevents rot. Any leaves on the cutting below the soil should be removed. It is a good practice to remove extra leaves from other portions also to reduce transpiration loss. Sun, wind or dry atmosphere can cause excessive transpiration; this can be reduced by planting cuttings in a semi-shady and protected place.

Plant a cutting in accordance with the general observations for planting. Water regularly keeping the soil moist, but excessive watering can cause rot.

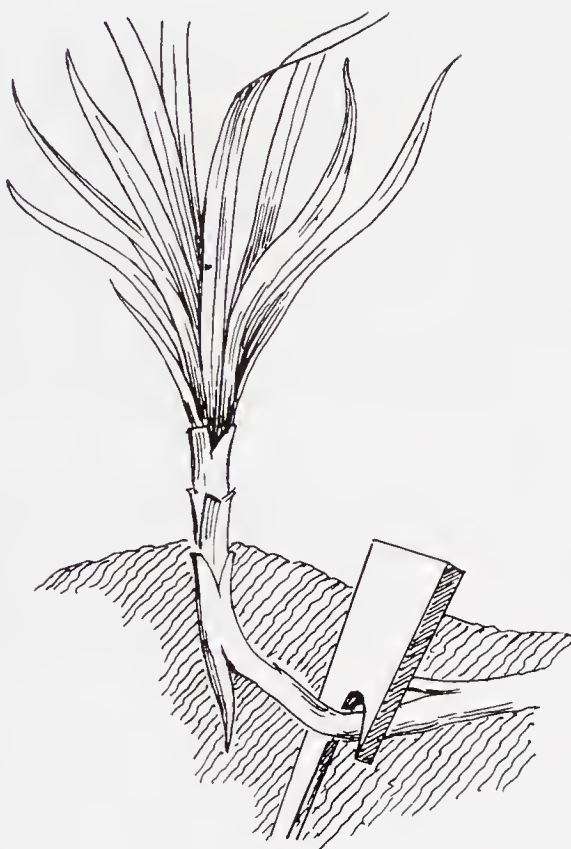
If the cuttings are planted in pots, insert them near the edge and put as many as possible; crowding stimulates their root growth. While rooting cuttings in the ground, also, they must be so closely placed so that leaves touch each other.

Transplant cuttings only after they are well rooted. New growth is not always a sign of good rooting.

Treatment of cuttings with root-forming hormones is recommended by experts. A suitable rooting hormone readily available in India is a May & Baker product called Seradix. It is available in different concentrations as Seradix B₁ for soft-wood cuttings, Seradix B₂ for semi-hard wood cuttings and Seradix B₃ for hard-wood cuttings.

Root division. The division of a plant into two or more plants with roots is called 'root division'. This is the easiest method of plant propagation. In a plant where two or more rooted branches are clearly visible, such division can be done by gentle pressure of the hand or with a little help from the garden fork or *khurpi*. In other cases, it is advisable to lift the whole plant, observe it and then divide, using a sharp knife. Many of the house plants can be multiplied by this method, like maranta, dieffenbachia, *Bellis*, gerbera, *Kniphofia* and *Chrysanthemum*.

The pineapple is an excellent example of propagation from suckers, and the strawberry of multiplication from runners. The difference between a sucker and a runner is that a sucker develops its roots at the base of the mother plant, while runner develops the roots at a little distance. The stolon is a runner with roots above the ground,



- (1) Remove leaves from underground and just above
- (2) Make a vertical cut 3-4 cm ($1\frac{1}{2}$ "') in the bark at underside of the shoot just before a joint and passing through it
- (3) Cover with $1\frac{1}{2}$ cm ($\frac{1}{2}$ "') of soil
- (4) Press it down with a peg or stone making sure that soil gets into cut portion.

Fig. 6. Ground layering as in carnations

though in common usage they are often interchanged. *Chlorophytum* is an example of propagation from stolons.

Layering. A layer is a shoot which is allowed to form its roots before it is disconnected from its parent. A layer may be made in the ground or in the air. The process of making a layer in the ground is known as ground layering and that of making in the air as air layering or popularly known as 'gootying'.

Ground layering is done by making a small vertical cut about 3-4 cm ($1\frac{1}{2}$ in.) in the bark at the underside of the shoot just before a joint and passing through it. Pull the shoot down in the soil without breaking it. Remove leaves from the underground portion. Cover with $1-1\frac{1}{2}$ cm ($\frac{1}{2}$ in.) of soil and press it down with a peg or stone, making sure that soil gets into the cut portion. Stake the growing shoot to avoid any pressure on the cut. This also encourages vertical growth. A layer would normally root in 15-20 days. Sever from its parent when new growth develops. This may take about 4-6 weeks. Transplant a few days after it has been severed. From a long branch a number of such layers can be made at a time by making cuts at regular intervals. This is called serpentine layering.

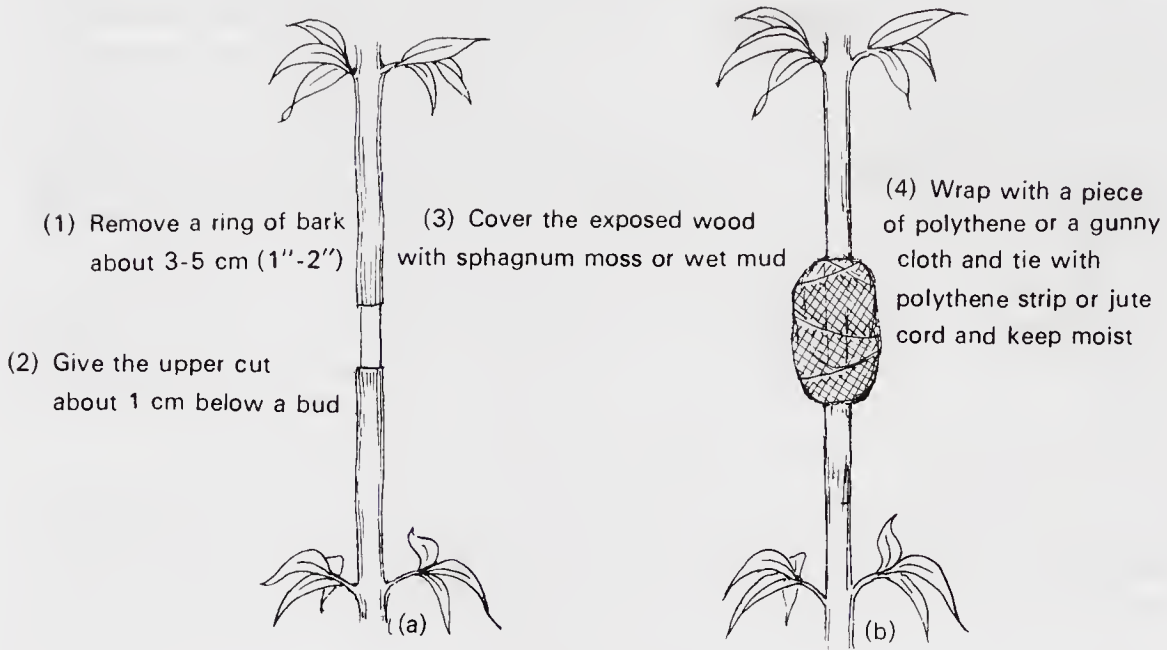


Fig. 7. Air layering or gootying

Ground layering can be adopted successfully in jasmine, carnation, *Hydrangea*, *Azalea*, climbing rose, *Vinca major*, raspberries, black-berries and a number of fruits and trailing plants.

Air-layering is a popular method of vegetative propagation of woody trees and shrubs. For fruit trees, this is one of the best methods of propagation; grafting being the other one. *Bougainvillea*, *Magnolia* and *Rhododendron* are well-known examples of propagation by this method. In this method, remove a ring of bark, about 3-5 cm (1-2 in.) in length from healthy shoot one or two years old without damaging the wood. Give the upper cut about 1 cm ($\frac{1}{2}$ in.) below a bud. Cover the wood from which bark has been removed and also a portion of the shoot above and below it with moist sphagnum moss. Wrap with a piece of polythene film or gunny cloth and tie both ends with jute rope, raffia or polythene strip.

Polythene film helps in preserving moisture and thus saves the botheration of frequent watering. Coconut fibre can be used in place of moss. Some gardeners use soil also around the cut, kept moist with a piece of gunny cloth.

In the case of soft or brittle wood, removal of bark is difficult. Make a cut half way through the stem and upwards for about 5-6 cm ($2-2\frac{1}{2}$ in.). Insert moss between the stem and the cut portion so that they do not rejoin. Cover the cut portion of the shoot with moist moss and wrap with polythene film as above.

Time taken for rooting varies with the variety. A *Magnolia grandiflora* or *Brownea*

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ariza layer may take two to three months while mango may require one-and-a-half months or guava only three weeks. The roots formed will soon become visible under the moss. The polythene film or gunny bag can then be removed and the layer can be severed from its mother plant after a few days. The plant thus obtained is popularly known as a 'gooty'.

Budding. A 'bud' or an eye of the variety selected, known as scion, is inserted in a growing stock in such a manner that the plant enjoys the vigour of the root-stock and the quality of the budded variety. This method is known as budding. This is the most popular method of propagation of modern roses.

The best time for budding is when a plant is in its optimum growth. In roses it is done in December-February in the plains. Later budding may result in shrivelling of the bud due to exposure to hot weather. The process of budding comprises the following steps:

- (a) A healthy 'eye' full of vigour but not yet elongated is selected.
- (b) The 'eye' is cut off from its parent along with a portion of the bark and leaf. The woody portion, if any, below the bark is removed. The leaf is cut off leaving about 1 cm (1/2 in.) along with the eye. It serves as a protection from direct exposure as also a handle at the time of insertion in the stock. Remove thorns if any.
- (c) Clean the stock of any leaves below and just above the proposed cut. The thorns near the area of proposed cut are also removed.
- (d) In the stock a vertical cut is made starting from about 1/2 in. above a node up to 1 cm (1/2 in.) below the next node, just sufficient for the eye together with its bark to be inserted in it.
- (e) Another horizontal cut of about 1 cm (1/2 in.) is made just at the top end of the vertical cut in the stock so as to make T-shape.
- (f) Loosen the 'T' shaped cut and insert the 'eye' into it.
- (g) Tie up with raffia or polythene strips around the eye from bottom upwards to remove any air bubbles.
- (h) After budding when the 'eye' shows signs of swelling, the top of the stock is bent over to reduce transmission of sap above and encourage its flow to the eye.
- (i) The bud unites with the stalk in about 15 days.
- (j) The stock is cut off just above the bud after 3-4 pairs of leaves appear from the eye.
- (k) Shoots arising from the stock, i.e. below the junction of the stock and the scion should be removed.

Grafting. The principle of grafting is the same as that of budding with the difference that in grafting a cutting instead of an eye of the selected scion is inserted in a growing stock. The purpose also is the same, i.e. to combine the vigour of the growing stock with the quality of the scion. This is the most popular practice in propagation of fruits.

PLANTING

Planting means putting a plant material in the soil. It may be in the form of transplanting, i.e. shifting a plant from one site to another or inserting a cutting or putting in a bulb. 'Saddle planting' means planting in such a manner that the plant rests as if on a saddle. The soil underneath is given the shape of a gently sloping mound or hill and the roots of the plants are spread over it. This gives a firmer base to the plant-roots. It is said that flag iris and asparagus do better with saddle planting.

Essentials of planting. Some of the essentials of planting are briefly described below:

(a) Planting may be done preferably late in the afternoon as this would save the plant from immediate excessive transpiration which takes place in day time.

(b) Provide light shade, if possible, to the plant till it is established, to prevent shock due to direct exposure to sunshine. This is more essential during hotter period.

(c) The soil where the plant is to be put must be prepared in advance.

(d) Plant to be uprooted should be watered some time before. Ideal condition is that the soil is moist and the plant is dry. Do not plant when soil is wet or soggy as even firming will be difficult and this is likely to leave air pockets.

(e) Dig the plant with the roots intact and as much of earth ball as possible. This gives the plant minimum shock.

(f) Spread the roots as they grow and do not let them crowd, twist or interlock.

(g) If a stake is required, stake the plant as soon as the roots are spread out. Do not insert a stake immediately after planting as this is likely to cause greater damage than inserting the stake after the plant is established.

(h) Hold the plant in the left hand and spread the roots with the right hand. Make a small hole and insert the roots as naturally spread out. The roots must touch the soil firmly, at the same time not allowed to get twisted. Gradually put in the soil, holding the plant firmly and firm it.

A mistake generally committed is to firm the soil only after all the soil has been put. This sometimes leaves air pockets near the roots which is fatal for the plant. Firming should not be postponed till the end except for seedlings, cuttings or small plants. From polythene bags or pots, plants can be transplanted any time provided necessary precautions are taken. In dry weather, mulch the plant after transplanting.

(i) After the last lot of soil mixture has been added, firm all around the plant. In case of bigger plants, soil may be firmed with the foot.

(j) A safe guide regarding the depth of planting is that the portion inside the soil should be up to the original level, except of course, where the original level was defective. The depth of planting should be as the natural growth of the plant requires. Deep planting, like deep sowing, is defective. Plants like onions if deep planted, may not form bulbs. Similarly, orchids with pseudo-bulbs like *Cymbidium* or *Phaius* may rot or may not flower if pseudo-bulbs are planted too deep.

(k) After planting, water gently with a fine rose.

(l) If the soil is too soggy or the bed is not ready, 'heal in' the plants, i.e. put them in a shallow hole or trench and cover the roots with soil up to the original soil mark, pending their transplantation to their permanent home.

(m) After planting, put the plant in shade or cover with light shaded material like straw or newspapers or straw mattresses known as 'hoglas', if possible, to avoid excessive evaporation. Excessive cold or frost is equally harmful. An ingenious device I have seen in Assam and Tripura is to provide a shade on the south-western side with a narrow piece of banana trunk. It looks attractive and keeps the plant cool.

It is reported that frost has a tendency to lift the young plants. Therefore, the soil around the plant should be firmed on the next day of heavy frost.

Not only seedlings and small shrubs but small and big trees can also be transplanted successfully. The process of transplantation of big trees needs organisational help and is not touched here. But small trees can be conveniently transplanted. It is better to undertake this operation during the rains to reduce transpiration loss. The process comprises the following:

(a) Prepare the pit in advance to receive the plant.

(b) Stake the tree with strong stakes. This will help in handling the plant.

(c) Draw a circle around the plant up to the extent of spread of its roots and dig it deep at the circle marking, loosening the earth near the roots.

(d) Take a big piece of gunny cloth and lift the roots of the tree keeping intact the earth ball around them. Carry the tree to its new pit holding it with the help of the corners of the gunny cloth and the stake.

(e) Gently lower the gunny cloth with the roots and do not remove the cloth. Remove the stake, if not required. Cover the roots with soil and press it while filling.

(f) Press with foot or wooden mallet finally and water copiously so that it reaches the end of the roots. If it is a hot day give the tree a light thatch covering to reduce transpiration loss.

(g) Water regularly till the tree is well established.

By this process, the first big plant I transplanted was a 4-year-old peach tree in Shillong in the month of June. Its fruiting in the month of May-June next year was better. Thereafter, I successfully lifted many old trees, some 8-10 years old, and it included double Sikkim cherry, weeping willow, maple, camellia, lagerstroemia, mulberry, and fruit trees. Except one, *Alstonia scholaris*, all of them thrived.

Staking. Staking is giving a support to a plant for holding itself or its flowers or fruits in a desired position. It is also a protection against wind and heavy rain. Some essentials of staking are given below:

(a) It is better to plan for the staking from the beginning and stake a plant at the time of planting if the seedling or clone is tall and cannot stand erect without support. If it is a small seedling, it should be staked as soon as it needs it. In bulbous plants, staking should be done as soon as the bulbs are planted, to prevent any injury to the bulb.

(b) Staking should be firm. Plants which have to support heavy weight of foliage and flowers, like dahlias, should have heavy stakes, preferably providing support from all sides and not merely in the centre.

(c) Initial staking may be supplemented by further support, e.g. in peas, small bushy stakes may be given in the beginning; but as soon as the plant grows about four pairs of leaves, the final staking may be given.

(d) Length of stakes will depend on the weight and height they will have to support. A portion of the stake has to be underground to take the load above. The height of the stake should generally be about 5-8 cm (2-3 in.) below the tip of the flowering shoot. But in some cases to support heavy flowers, the stakes are provided up to the base of the top flower.

(e) Stakes much stronger than those for vegetables or flowers are required for fruits.

Methods of staking. Stakes may be of bamboo, cane, wood or *sarkanda* (*Saccharum spontaneum*), *ekra* or other suitable material. Any one or more of the following methods may be adopted for a plant:

(a) Single stem stake is usually used in tall, slender plants, like the annuals. Flower shoot is loosely tied to the stake.

(b) Multiple single stakes are given for each flowering shoot of a plant, as in chrysanthemums or in the annuals, for supporting a number of flowering shoots for providing a mass effect.

(c) Series of stakes as in sweet peas or beans.

(d) Ring stakes as in carnation or *Petunia* and *Verbena* in pots. In this method a number of single stakes inserted in the ground are joined together with soft thick string or wire.

(e) A strong angle stake is used as a stake fixed at an angle to the shoot it supports, as for fruit trees.

Labelling. Labels in use in a home garden can be of two categories: (a) permanent or fairly permanent, and (b) temporary, which can be changed with each season.

The evergreen plants, trees, shrubs, may be given labels of a permanent nature. The annuals or bulbous plants may need labels of temporary nature which may be washed or wiped after their use during the season.

The types of labels may include (i) tin plates, painted with black on which the name is written in white, (ii) aluminium foils on which name can be written with pencil, and (iii) plastic labels.

I find the easiest to handle are the aluminium foil labels which can easily be cleaned with water and soap. They are fairly permanent and are useful for both the purposes. They are very light and require very small storage space. The tin labels involve more labour in getting the names painted and also any change requires repetition of the same time-consuming process. Plastic labels are more likely to crack or get chipped off due to handling.

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A plant should be labelled as soon as procured. For bulbous plants stored separately according to different colours, labelling should be done as soon as the flowers open. For seeds for storage, paper labels may be affixed on glass bottles with tight lids.

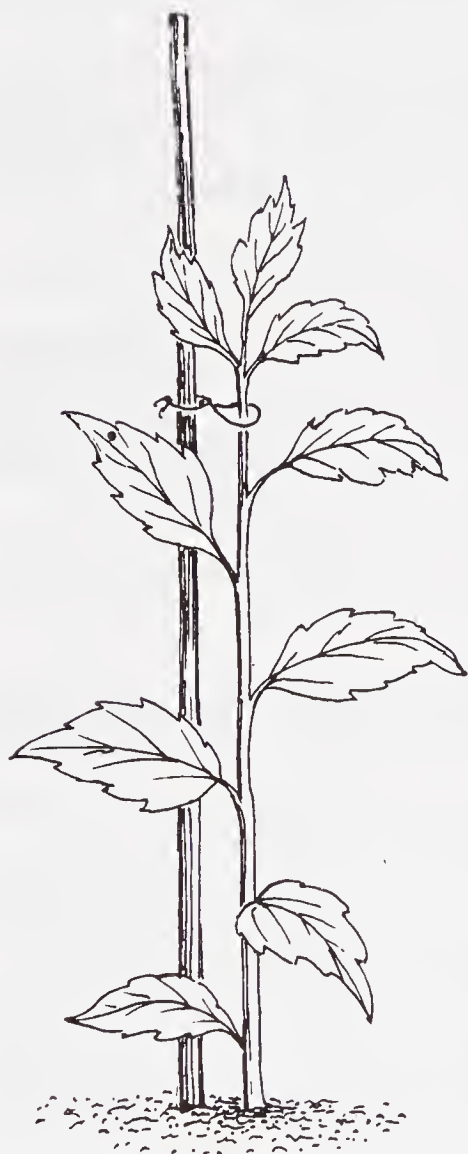


Fig. 8. A single stake

The labels may be tied loosely to a branch or shoot of a plant. In case of trees or shrubs, the label can be nailed on the trunk, care being taken that the nail does not go deeper than the bark. Care should be taken that when the shoot or branch is cut off, the label is shifted to another part of the plant. The risk generally arises when a large number of bulbs labelled with different colours are taken out at a time. Beware of the mix-up likely to happen if inexperienced help handles the job of labelling a number of plants. For correct spelling of scientific names, the memory alone need not be trusted as they are like 'slippery customers'.

Naming of plants. The popular name of a plant varies from place to place. Identification is easy and uniform through its Latin name. A name in Latin or Latinized language, consists of two to three parts: The first component is the name of the genus and its first letter is given in capital. The second component is the name of the species, the first letter of which is given in small. The third component may or may not exist in each name; it stands for a detailed variety and follows the name of the species. The first letter of the variety is also given in small. Between the name of the species and detailed variety, the word 'var.' is added, e.g. *Áchillea millefolium* var. *rosea*. In common usage, sometimes, the word 'var.' is dropped.*

*If a plant is raised by crossing two varieties or genera or species, it is named by denoting ^ between the names of two parents, e.g. *Cymbidium eburneum* crossed with *Cymbidium lowianum* known as *Cymbidium eburneo-lowianum* is denoted as *Cymbidium eburneum* ^ *Cymbidium lowianum* = *Cymbidium eburneo-lowianum*.

PLANT WATERING AND FEEDING

Watering. The principle of watering is that the plant roots must remain moist to enable its roots to draw food from the soil and reach it to the outside extremities. Due to lack of water, moisture from the plant evaporates and it withers. Whenever the leaves of a plant droop, the first thing to check is whether the plant has been watered adequately or not. Next to check would be drainage or pests and diseases.

Excessive watering is equally damaging. It drains off micronutrients necessary for the plant and also creates conditions similar to water-logging, resulting in rotting and disease. Watering is a must whether in the plains or in the hills. Its frequency depends upon the weather, nature of plant and stage or period of growth. In summer or in the plains, it may be as frequently as twice a day; in the rainy season or in the hills, watering may not be done for a number of days. A shallow-rooted annual plant will need more frequent watering than a deep-rooted fruit tree. A plant needs less water during its rest period and more water when it is actively growing or is bearing flowers or fruits. In fact, a plant needs generous water supply when buds are forming and the plant is in bloom. Tender seedlings need more frequent watering than the mature plants.

Watering should be done only when it is required. Whenever it is undertaken, it must be thorough. Frequent inadequate watering draws surface roots to the top, causes rapid transpiration and exhausts the plant.

For pots one of the best methods is to close a water-drain by placing two stones or bricks and fill it with water or use a shallow reservoir or bath tub. The pots may be inserted in the drain or tub so that they get thorough soaking from beneath. This can also be done by placing the pot in a water-filled shallow pan. A friend, who succeeded in growing luxuriant rich gloxinia from seeds, said his secret was in watering this way. This is, however, time-consuming and may be undertaken for rare or more difficult plants.

A good way of testing whether the pot has been thoroughly watered is to check whether a little water comes out from the bottom hole. In case of plants in the ground, this can be tested by digging in your hand by about 7-8 cm (3 in.) and seeing whether the soil is wet or not.

Another essential of watering is that it should be given in the same manner as the rain. Therefore, it should not be given with a hose without a rose or a sprinkler. It should not be given with such a force that it makes a hollow at the base of the plant. Water sprayers or sprinklers, which create mist effect, are the best for watering. The manufacturing of these for bigger gardens has started in India. No unit for small gardens is yet available.

Rain water, of course, is the best for watering plants, but is seldom available except during the rainy season. Tap water generally serves the purpose. In winter, if time and size permit, a large tub may be filled up with tap water and exposed to sunshine for four hours or so before watering. Very cold tap water in the winter gives a little shock to the plant system.

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Watering must be done in the early morning or in the evening when the soil around the plant is not hot. Should watering become necessary during the bright sunshine, the pot be removed to shade and soil allowed to cool down and then watered.

In the plains in summer, it is better to water in the evenings as overnight moisture helps in growth. In winter, it is better to do it in the mornings.

Plants frequently get covered with dust. They need a good spraying when watering not only to give them a clean appearance but also for improving their capacity for photosynthesis. The use of a sponge for foliage plants will be more effective than a sprayer.

Clean plants look happy. The same shrubbery and hedge look gay with the first showers of rain after a dry hot summer.

A light watering before the sun shines for a plant subjected to heavy frost at night is essential to remove the after-effects of frost-bite. Moisture in the plant helps in reducing the frost-effect. A light watering of plants on the day heavy frost is expected is likely to ward off immediate danger of frost-bite. Warmth stored up in the soil during the day is given off into the air around the plants at night and warmth rises much more quickly through dry soil than through moist soil which acts as an insulating layer or blanket.

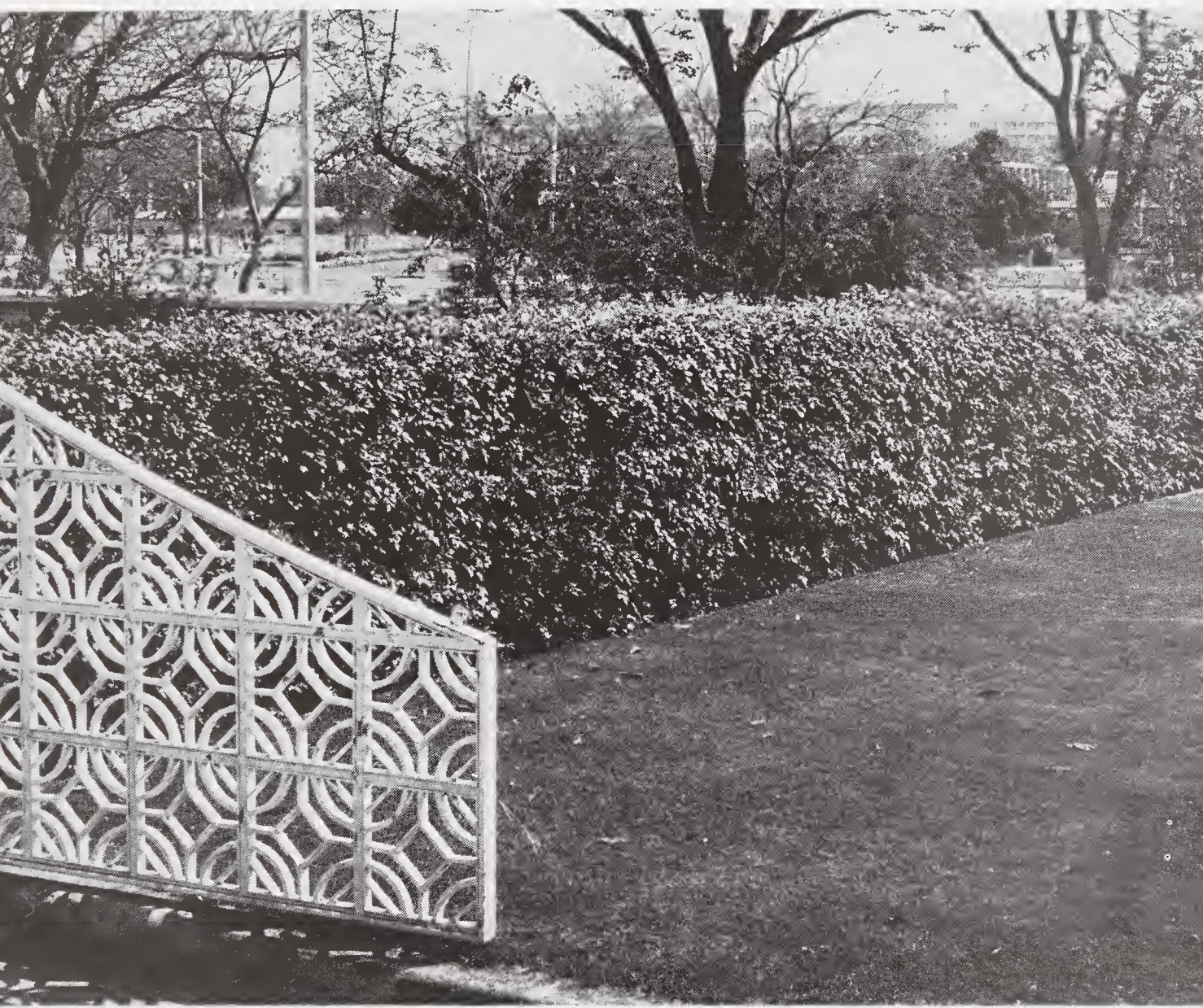
Liquid manure. A manure applied to a plant in the form of liquid instead of powder is called liquid manure. It is given to accelerate growth at a time when the plant is well established. For flowering plants, it is given when flower buds are forming. For evergreens, it is given during their most active growth period; to fruit trees when fruits are setting till they change colour; and to vegetables during the period of active growth.

The advantage of liquid manure is that it gives nutrition in immediately assimilable form at a time when the plant needs it most. An organic liquid manure also improves water-retention capacity of the plant. Liquid manure should not be applied when the plant is small or is in a dormant condition. Instead of causing benefit to the plant, it may turn out to be harmful. A plant must not be dry when liquid manure is given. It is advisable to water it an hour or so before giving liquid manure. The principle is to give liquid manure less and often, rather than much and seldom. For trees and shrubs, whose feeding roots are away from the stem, it is wrong to apply it very near the stem. It should be applied from 15 cm-1.2 m (1/2-4 ft) away from the stem up to the extent of the entire spread of the branches.

Liquid manure may be organic or inorganic. The most common organic liquid manure is of cowdung. I find it to be the safest and very effective. A couple of handfuls of cowdung is soaked in twice the quantity of water. It is covered and allowed to ferment for a day in summer in the plains and for three days in winter in the plains, or three days in summer and seven days in winter in the hills. Add water 30-40 times to form a mixture so that its colour is that of weak tea. One mugful may be given to a small plant. The mixture should be clear. Therefore, any deposits of the manure should be allowed to settle down, or the cowdung should be placed in a muslin cloth and then dipped in water. In case of non-availability of fresh cowdung, oilcake, soaked and fermented may



1. A view of a garden



2. A hedge of *Murraya exotica* (Syn. *M. paniculata*)

be used. Oilcake will take more time to ferment than fresh cowdung. Soap suds and soot water are also good as liquid manures.

Eggshell liquid manure is an interesting proposition and has been recommended by Smt. Lilian K. Donald in her book 'Ornamental House Plants'. Raw egg shells are soaked in water and allowed to ferment for about a fortnight.

Inorganic liquid manures would include nitrogenous, phosphatic or potassic manures separately, or combined with any two or all of them, according to the requirements of the plant. Do not apply these easily soluble fertilizers before rain as they are likely to be drained off.

Many keen gardeners keep apart a drum or an earthen vessel with a lid as a regular garden accessory. The fermenting of liquid manure then becomes a continuous process. One teaspoon of nitrogenous, one-and-a-half of potassic and two of phosphatic fertilizers in a litre of water is normally adequate.

Foliar application of urea on roses, chrysanthemums, foliage plants and lawns, etc., at the same rate as the liquid manure for nitrogenous fertilizers has been practised for exhibition blooms with successful results.

Mulching. This operation comprises spreading of lawn mowing, half-decayed leaves or straw about 5-8 cm (2-3 in.) thick or may be even more, around the base of a plant during summer and forking it in the topsoil. Saw dust or garden compost is also recommended by some, but I am not sure of the result. The thickness of the mulch may vary with the soil and variety of the plant; in fruit trees, the mulch may be as thick as 30 cm (1 ft). The main objects of mulching are to conserve moisture and to keep the roots cool from excessive heat. It incidentally provides nourishment also to the plant and suppresses the weeds. I used dry leaves, preferably not pine needles, in Shillong also during the dry season and found it very useful. The leaves are removed as soon as the rains set in.

PRUNING

'Prune' to make the plant behave properly as you 'punish' a child to learn. But do so discriminatingly, tenderly and only when it is necessary.

Pruning means cutting of certain portion of a plant, mainly to improve its vigour. It is based on the principle that a plant diverts its sap to the part where such a cut is made. In fruits, it is mainly to stimulate better fruiting. In flowers, it may be for more or bigger flowers. It may also be vigorously practised in hedges, trees, or shrubs to give a graceful shape. Pruning is also done for stimulating growth towards the under-developed side. Minor or incidental objectives are to remove dead flowers or weak, diseased, damaged or bruised parts of the plant.

Pruning should be based on intelligent understanding of behaviour of growth of a plant. Before venturing into pruning, it is better to study the plant and also talk it over

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with experienced gardeners or horticulturists. Some maxims of pruning are given below:

- (a) Make a clean cut with a sharp knife, a pair of scissors, secateurs or a saw.
- (b) Smear the cut with a white lead paint or coal tar or in the absence of any of these with wood-ash to prevent growth of fungus. The wood-ash soaks up the humidity of the cut portion and provides a sterilized medium. It has been generally found by me to be quite effective.
- (c) The best time for pruning is when a cycle of growth is completed and the next one is to commence. Plants which flower on the previous year's shoots should be pruned after flowering and those which flower on new shoots should be pruned before flowering.
- (d) If flowering or fruiting, whichever is the objective, is followed by summer or rainy season, pruning should be done immediately after flowering. If it is followed by autumn or winter, pruning should be done before flowering.
- (e) Make a cut slightly sloping just above and towards the eye or make a vertical cut flush with the junction of the part. A horizontal cut retains moisture and, therefore, is liable to cause fungus growth. A cut sloping away from eye is equally defective as the

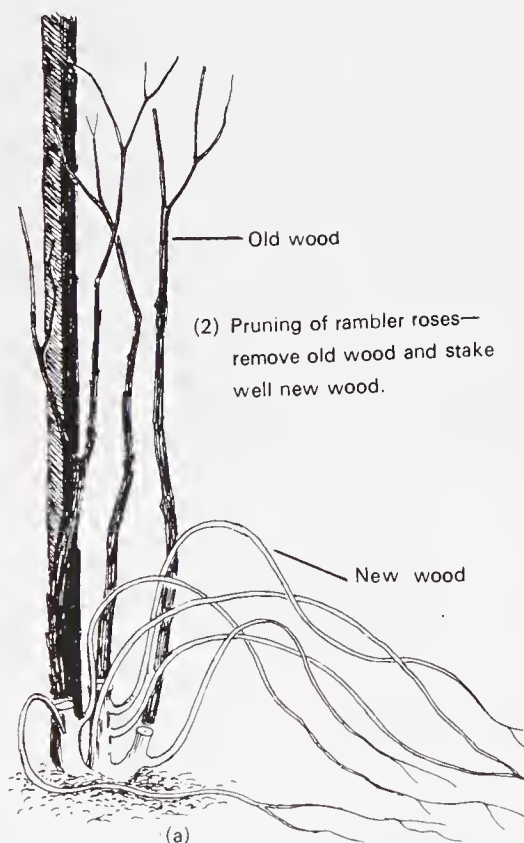


Fig. 9 (a) Pruning of rambler roses—remove old wood and stake well new wood; (b) Pruning a well-established rose bush



objective of the cut is to concentrate the sap as near the eye as possible to stimulate immediate growth.

(f) When two shoots cross each other, one should be cut back below the point of crossing. The objective is to avoid over-crowding of the centre and thus to allow air and light to pass freely through the foliage and flower/fruit.

(g) Cut above the eye which points to the direction you desire your plant to grow and select an eye pointing outwards. This would help in checking over-crowding at the centre also.

(h) Pruning serves as a stimulant for growth of the weaker plants. But it should be done carefully as such plants are more prone to fatal shocks.

PLANT AFTER-CARE

After the plant has been planted, it needs to be looked after. This series of operations is called 'after-care'. It includes (i) watering and feeding, (ii) staking, (iii) labelling and naming of plants, (iv) controlling pests and diseases, (v) hoeing, (vi) weeding, (vii) stopping, (viii) disbudding, and (ix) dead heading. Items (i) to (iii) have already been discussed in this chapter earlier. Item (iv) has been discussed in the subsequent chapter. The other minor operations are discussed below:

Hoeing. Hoeing or forking, as it may be called, is a simple garden operation in which the surface soil around the plant, roughly up to the spread of its leaves, is loosened with a hoe (*khurpi*) or a fork and is turned inside out. The hoeing may be up to 7-15 cm (3-6 in.) depth.

The objective of hoeing is to keep the soil porous so that light, air and water may reach the roots better, to improve moisture-retention capacity and to remove weeds. Some of the plants like lilies have stem roots while some others like roses have shallow surface roots. Hoeing has to be done carefully so that the surface or stem roots are not damaged.

Hoeing should be done when soil is moist or dry but not wet and soggy. In summer in the plains, watering has generally to be done daily. The best procedure for hoeing, therefore, I found was to water the plants in the morning, hoe them in the evening and then again water in the morning. In winter, of course, the frequency of watering being much less, this difficulty does not arise. But the policy is to hoe a day at least before watering rather than after watering. An interval between hoeing and watering helps in the aeration of roots and absorption of water from a greater depth.

Proper time for hoeing is early morning or late afternoon as for watering. Sudden exposure to heat during the hot sunshine period or to cold at night may cause damage to the roots. Manuring or mulching of the plant should better be preceded by hoeing.

Weeding. Removal of weeds is called weeding. A plant which may be a weed in one garden may be a garden plant in another, e.g., lantana is a weed in many gardens but it

fascinates many others who cultivate it for its blooms. Similarly, in the same garden, a plant may be a weed at one place and a cultivated plant in another, e.g. a vegetable marrow plant in a row of gladioli is a weed while it is a cultivated plant for the kitchen garden. A weed thus is a plant growing in a place where it is not required.

Weeds, besides competing with the garden plants for nourishment, are also sometimes hosts to pests and diseases which are transferred from them to the garden plants. They should, therefore, be removed as soon as they appear.

To remove the weeds, which may be annual, biennial or perennial, the first principle is not to let them seed and to cut them off from the surface. But it is not enough in the case of perennials. They should be removed with their roots. There are certain weeds, like oxalis, which are a nuisance in certain areas. They have tiny bulbs at their rootlets and unless they are removed it is not possible to eradicate them. Therefore, they should be hand-picked after digging deep, and burnt. *Mimosa pudica* (*chhui mui* or *lajwanti*) which closes its leaves just by a touch is attractive with its tiny round light-pink powder puff-like flowers but can be a nasty perennial weed. *Doob* grass, a luxury as a lawn, is also a troublesome perennial weed with its trailing roots in some areas. One of the worst weeds most difficult to eradicate is *motha* (*Cyperus rotundus*).

There are some parasitic plants which do not manufacture their own food and feed upon others. Some are complete parasites which depend entirely for their feed on the other plants while there are half parasites which partly manufacture their food and partly feed upon other plants. In the former case, they do not have any chlorophyll mechanism while in the latter they do not have adequate mechanism. They may feed on the roots or aerial parts of the host plant. Common examples of parasites are *amarabeli* (*Cuscuta*), and *bandgul* (*Loranthus longiflorus*). Such plants should be removed immediately after detection and burnt. They should not be put in the compost pit.

Stopping. Stopping means pinching of 1-2 cm (1/2–1 in.) of a growing shoot of a plant. The main growing shoot bears the flowers earliest. By pinching off this shoot, it is stopped from flowering early. Its energy is then diverted to the growing of a number of side shoots. Thus the plant, subjected to such a treatment, will be more bushy, compact and will give more flowers. It will also prolong the period of flowering. This kind of stopping need not be practised if an erect, tall plant with less bushy growth is desired.

Stopping also includes removal of side shoots growing from the axil of the leaf joint with the main shoot as in balsam, larkspur, double stocks, or tomato, in order to let the energy of the plant be diverted fully to the flower stem.

Stopping is practised in plants for bushy or compact growth as in *Chrysanthemum* or *Petunia*. It is also practised in bushy or trailing vegetables like vegetable marrow, pumpkin, cucumber, tomato etc.

Stopping may be done more than once depending on the growth of plant and its variety. Generally, stopping more than two to three times during a season is not required. In the first stopping the main growing shoot or the leader is stopped. In the second stopping, the lateral shoots are stopped. In the subsequent stoppings, sub-lateral shoots are stopped.

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Stopping is like performing a surgical operation on a plant and, therefore, give it a shock. It is better not to stop more than one or two big shoots and 3-4 small shoots at a time in a plant.

The shoots are more full of a sap and are brittle in the morning. Therefore, it is better to do stopping at that time. Bulbous plants do not need any stopping.

Disbudding. Disbudding means removal of all but one or two selected buds on a stem. A plant produces a very large number of buds for seed and, therefore, for flowers. If all of them are allowed to flower, the flowers will be small and the plant will get exhausted very quickly. The objective of disbudding is to produce good blooms over a long period. For exhibition, the disbudding has to be more severe than for garden purposes. Plants which have large and decorative flowers need more disbudding than those with small and medium flowers. Large decorative dahlias need more disbudding than the 'pompons'.

Plants which are more prolific producers of buds need more disbudding than those which produce less. Chrysanthemum, dahlia and carnation require heavy disbudding, while roses need comparatively less of it.

Dead heading. Removal of withered flowers from the plant is called dead heading. Flowers are produced in nature for producing seeds and as soon as seeds are produced the natural function of the plant having been over, it dies or rests. Therefore, a garden plant should not be allowed to seed except for purposes of collection of seed. Removal of withered, dried flowers is thus to prevent the plant from seeding.



Pinch off main stem when carnations
10 cm (4") tall and well established

Fig. 10. Stopping of carnations

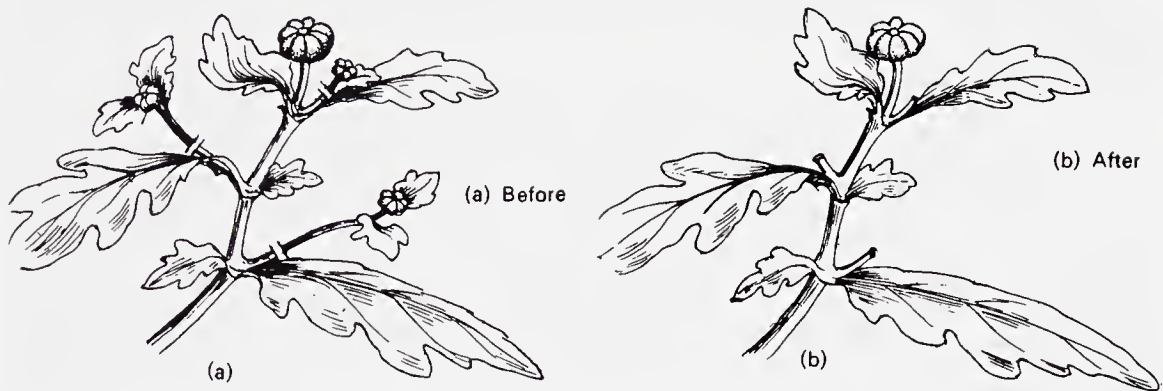


Fig. 11. Disbudding of chrysanthemums

Removal of suckers/runners. In budded or grafted plants, all suckers or shoots, below the point of budding or grafting should be removed. Sometimes plants like bananas, pineapples, some palms, and chrysanthemums produce suckers as a natural process of propagation. The extra ones should be removed. Similar is the removal of excess runners produced by the strawberry plants.

4

PLANT PROTECTION

HEALTHY plants grown with adequate nutrition and water are less susceptible to pests and diseases than the sickly ones grown indifferently. Plants which grow under controlled conditions, need more care than those which grow outdoors.

Difference between a pest and a disease. A layman is not generally familiar with the difference between a pest and a disease while an expert would be perturbed at this ignorance. As we have to save our plant from both categories of enemies, it is better to understand their behaviour. A pest is an enemy of plants, which is a living creature like bird, cattle, insect, fly, caterpillar, slug, snail, bug, scale, etc., and causes damage above a critical level. A disease is a physiological disturbance in a plant caused by fungus, virus, harmful bacteria, deficiency of minerals, etc.

Preventive measures. Prevention is better than cure. Therefore, it is advisable to grow disease-resistant varieties and buy seed from certified agencies. Well-known disease-resistant or tolerant varieties are in the market, for example, 'Kufri Jyoti' potato is tolerant to late blight. These are generally available from the National Seeds Corporation. The tolerance to mosaic of 'Pusa Sawani' *bhindi* has broken.

The preventive measures would include good agronomic practices also. All propagation should be from disease-free plants. Diseased parts of the plant should be burnt or destroyed. Other things being equal, acclimatised plants are likely to be less susceptible to disease and may be used in preference to the exotic ones.

An easy method, though not fool-proof, for sterilization of soil is to burn wood, garden refuse and household rubbish on the proposed plot of land, make a good fire and keep it for a week. Turn the soil inside out before making it ready for planting material. In the USA and many other countries, mechanical methods of sterilization are being adopted.

Control measures. The measures for control of pests and diseases may be cultural, mechanical or chemical. Biological control has gained importance, of late, though not yet in the home gardens.

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CULTURAL CONTROL. This would include the following:

- (a) Destroying the hiding places of pests.
- (b) Removing weeds and wild plants which may act as hosts for a pest or a disease.
- (c) Ensuring crop rotation; this keeps down the population of pests of a particular plant.
- (d) Using farmyard manure and compost in well-decomposed form; otherwise they would attract white ants, black ants and other pests and diseases.
- (e) Checking on drainage; water-logging encourages pests and diseases. Always grow the seedlings in a raised seedbed with good drainage. This will avoid water stagnation and prevent 'damping off' of seedlings.
- (f) Thinning out the excess plant population because over-crowding provides a favourable condition for growth of pests and diseases.

MECHANICAL CONTROL. This would include the following:

- (a) Handpicking of insects like mealy bugs, caterpillars and beetles, and other pests like snails and slugs.
- (b) Removal of clusters of eggs of insects by rubbing them off with hand or with a tooth brush dipped in methylated spirit.
- (c) Removal of affected branches or shoots, leaves or flowers, as the case may be.
- (d) Removal of affected plants to prevent spreading of disease from one plant to another.

CHEMICAL CONTROL. This may include the following:

- (a) Traditional household remedies which have no toxic effect.
- (b) Toxic pesticides available in the market.

The chemicals may be applied by spraying or dusting. They may even be applied in the soil before planting, like nematicides for control of nematodes. A good sprayer is very useful for spraying. In the absence of such an appliance, a 'Flit' gun can be used. Normally the packing of the pesticides includes a spoon for measuring and it is necessary to follow the instruction given there. A rough-and-ready method of measurement is that a standard teaspoon is 5 g and a tablespoon is 15 g approximately. If a pesticide is to be applied in the strength of 0.1 per cent in water, a level teaspoonful in five litres of water will do. Thanks to the Milk Supply Schemes, standard half-litre bottles are available.

I found *neem* (*Azadirachta indica*) leaf decoction to work against all pests and diseases I got in my garden. The leaves are boiled in water and the decoction is sprayed. About 50 g of leaves in 1 litre of water boiled for 10 minutes would suffice. Another most effective remedy I found was the use of turmeric against ants. The ants don't die but leave the place.

The other household remedies may include turmeric powder for ants, kerosene for

ants and white ants and a nicotine and soap solution, etc. Nicotine-soap solution, is good for leafy vegetables like cabbage, cauliflower or various *sags*, but helps only in cases of minor infestation. On the other hand *neem* decoction coupled with hand-picking of caterpillars and the eggs on cabbages, etc., worked wonderfully.

Nicotine-soap mixture

Washing soap 30 g (1 oz)

Tobacco leaves 30 g (1 oz)

Water 1.8 litres (3 pint)

Boil them together till the soap is dissolved. Cool and store; can be kept in a bottle for a few weeks. If a pot plant is badly affected, dip it upside down in the mixture after protecting the soil by covering it with a strong paper.

Just as a healthy person seldom needs medicine, and gets over minor ailments without drugs, so also most of the healthy plants thrive in home gardens without much use of pesticides. But in severe cases, these become essential. Given a choice, a pesticide with low mammalian toxicity should be preferred to one with higher toxicity.

While using a toxic pesticide, the following precautions should be taken:

(a) It should be applied on a dry day without strong wind. On a rainy day it may be washed off too quickly.

(b) It should be used strictly according to the instructions. Less dosage may not be effective; more may be harmful to the plant.

(c) Hands must be washed carefully with soap after application. It is better to keep a container, separate from the household containers, for mixing the chemicals.

(d) Be careful in storage. The chemical should be labelled and kept away from the reach of small children. It should be distinctly marked as poisonous.

(e) It is recommended that vegetables should be consumed only after three weeks of such a spray. Even in the case of non-toxic pesticides, it would be advisable to allow a gap of at least three days before consumption. As many vegetable heads as are ready or about to be ready within the prohibited period should be plucked before applying the pesticide.

(f) It should be applied in the morning or late evening; if applied during hot hours, it may endanger the foliage. The chemical should not be inhaled at the time of application.

(g) The container and the sprayer should be washed with clear water, immediately after use and also before use. Mixing of pesticides is very dangerous in some cases.

The quantity of chemical to be used as recommended here is based on 100 per cent strength unless otherwise stated. If the commercial chemical is of less strength, the quantity of chemical should be proportionately increased. For making a paste, mix water and the chemical roughly in the proportion of about 3:1.

An attempt has been made here to restrict the number of pesticides, etc., to the minimum so that by storing about three to five chemicals the gardener may be able to

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control most of the common diseases and pests. In New Delhi, the gardeners can take advantage of the services offered by the Plant Protection Directorate, N.H. 4, Faridabad. They sell chemicals as well as advise the gardeners and agriculturists regarding identification of pests and diseases and the use of chemicals.

COMMON PESTS

BIRDS AND ANIMAL PESTS

Birds nuisance. Sometimes the whole crop of fruits or vegetables may be lost due to the bird menace. The seeds of precious flowers may not be available as they find favour with the birds. Some birds are partial to sweet seeds as of peas, maize and sunflower. Parrots might be an attraction for children but not for the grape gardener.

The easiest and also the traditional method in a small garden is to cover the plant with chicken wire, preferably with a frame which would allow its repeated use. The chicken wire, if painted, will last longer. A more recent material is nylon nets.

It is also widely recommended that black thread woven criss-cross closely, would also prevent the birds. I have not tried it.

A modern method is to use electric fencing which would give shock to the birds if they perch on it. This prevents them from coming near the garden in future. A naturalist would not favour this nor is it safe when children are in the house.

Monkey nuisance. In our ancestral garden in Jabalpur, we have not been able to find any effective control. The only remedy is to grow plants which they don't eat like bougainvilleas, cacti and other thorny ones and root crops etc. It is said that they do not like papaya, lilies, sugarcane and some seasonal flowers. They are very fond of roses, vegetables like tomatoes, brinjals, peas, Bengalgram, *palak*, *methi*, chillies etc. and sweet or new leaves of *Bauhinia*, mango etc.

RODENT PESTS

The most common rodent pests are rats and mice. If you have them in your garden, try the following:

- (a) Traps. These alone may not be effective.
- (b) Locate the burrows if you can and kill the rodents. They generally cause damage during the night.
- (c) Use poison baits. Rat poison available in powder form in the market can be mixed with flour and made into small balls. But these should be kept out of reach of children and also of pet animals.

INSECT PESTS

Ants. These tiny creatures can even prove fatal to the plants due to their massive

colonies. They are very partial to some of the bulbous plants like dahlia. The presence of ants generally indicates existence of aphids, mealy bugs, scale, etc. The removal of the cause is necessary.

I found turmeric powder to be the most effective. Sprinkle a little powder all around the plant, over the leaves and stems of the plant and also along the routes of the ants. If not effective, repeat on the next day. Two applications have been found to give almost cent per cent effect.

One teaspoonful of kerosene in five litres of water to be spread around the plant is also recommended.

Aphids. These are the plant lice and may be brown, black or green. They are very small in size and multiply very quickly. The male adults have wings and also fly. They attack the tender parts of the plant and underside of the leaves, buds and flowers and draw out the sap. The plant, after showing initial stress conditions, gradually withers away. They are very common in *Chrysanthemum*, *Geranium*, *Dianthus*, dahlia, lily, poppy, rose, potato, citrus, beans, cabbage, etc. The active period is usually March-April.

CHEMICAL CONTROL. Sprinkling of lime or salt water is helpful. Spraying with soap-nicotine solution cures minor infestation only. For severe infestation, spray Metasystox 0.025 per cent or Malathion 0.03 per cent, i.e. about 1/2 teaspoonful in 1 litre of water, 1 litre of such mixture for 10 m² area. One spray will be normally sufficient.

Leaf beetles. This is an important pest on cucurbits, some ornamental plants and fleshy vegetables. It particularly destroys the floral parts and thus affects the fruit formation. The adults collect on the plants in groups and destroy the floral parts very quickly. If disturbed, they fly and settle on the neighbouring plants.

CONTROL. Collect and destroy by immersing in kerosene oil.

Epilachna beetles. These beetles are serious pests of vegetables specially brinjals, potatoes and cucurbits. They make irregular punctures in the leaves. The allied members of this group of insects are predators (who eat aphids) and are useful to farmers. The adults as well as the larvae destroy the leaves by eating the green part between the veins leaving the skeleton of the leaf. The beetles are round with the head hidden by the wings. They are brownish yellow to deep orange with black spots or patches. They lay a large number of yellow eggs on the underside of the leaf. The eggs hatch in three to four days. The young insect is covered on its surface with spiny outgrowth and are mostly confined on the lower surface of the leaf. This insect undergoes several changes before it becomes an adult. This takes nearly 30 days. They are most active in north India in the rains in *kharif* season. In the south, they are active throughout the year.

CONTROL. Spray Endosulfan 0.1 per cent or Malathion 0.05 per cent. One or two sprays at the most are enough.

Red pumpkin beetle. This is a severe pest on cucurbits. The adult insect is orange-coloured, oblong and is attracted by tender vegetables. It eats not only the soft portion but also the veins of the leaves. A large number of beetles concentrate on young seedlings and eat them. The larvae of the insect attack the stem, roots and sometimes the fruits.

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They hide during winter and become active in the monsoon period in north India and almost throughout the year in the south.

CONTROL. Grow a few scattered plants of cucurbits early in February-March to attract the beetles soon after the end of winter. Destroy these beetles, when the infestation is severe, by dusting the plants with 10 per cent BHC.

Rhinoceros beetle. This is a very serious pest of coconut. The adult beetle is black with smooth-surface, hard wings and a pointed horn. It bores the tender growing part of a palm. Due to repeated attacks the palm dies in a few years. The beetles are very active in March-April and continue their attack till October-November. Then they go to the manure pits and decaying leafy matter and lay eggs there. The grub pupates in the soil and the adult beetle emerges.

CONTROL. (a) Mechanical removal and destruction of adults is important.

(b) The breeding places should be dusted with 5 per cent BHC.

(c) The leaf axils attacked by the beetle should be filled with 5 per cent BHC dust mixed with equal quantity of sand. Sand is recommended to close-up the wound and prevent further boring.

(d) Dust 5 per cent BHC twice a year normally — one in March-April and the other in October.

Shoot and fruit borers. Two species of borers affect brinjals. One type of caterpillars bore into the petiole, midrib, young shoots, fruit buds and fruits. They are pinkish-violet in colour. The other type bores only the stem and goes downwards of the plant and they are creamy-white. Both the pests become moths at the adult stage. They lay 100 to 150 eggs scattered on the leaf surface. They hatch in four days and these young ones immediately enter the plant tissues. The infestation is observed by the wilting of the shoot which dries up later.

CONTROL. (a) Prune all the shoots showing wilting.

(b) Spray with 0.25 per cent DDT at fortnightly intervals, during the fruiting season. Chemical control will not kill the larvae which have already entered the shoots and fruits but can prevent further infestation.

The caterpillars and grubs of a number of moths, weevils and beetles bore the fruits, the stem and bark of woody trees including fruit trees, and cause considerable damage. They can be detected by the presence of excreta mixed with the wood powder in the tunnels. In the brinjals, the infestation is observed by the wilting of the shoot, which dries up later.

CONTROL. (a) Prune young twigs which are badly damaged.

(b) Scoop out fresh infestation and destroy the grub or caterpillars.

(c) Spray with Endosulfan 0.1 per cent on the affected parts.

Anar butterfly. This is a serious pest on pomegranates and is responsible for heavy loss in fruit yield. The butterfly lays eggs on young fruits and flowers. The caterpillars bore inside the flowers, and fruits and feed on the seeds. It pupates inside the fruit and emerges as a butterfly.



3. Damage to cabbages by butterfly larvae



4. Different stages of larvae of citrus butterfly (*Pâpilio* sp.)

5. Cabbage butterfly (*Pieris brassicae nepalensis*)





6. Leaf miner on citrus

7. Rust. common in beans and soybeans



PLANT PROTECTION

CONTROL. Protect the young fruit by covering with either coarse white cloth or brown paper. It is preferable to dip the cloth or paper in DDT solution as below. This is sufficient for small gardens.

Lemon butterfly. This is a common pest attacking the *Citrus* family. The butterfly with a shallow tail is very beautiful to look at. It lays eggs on the tender leaves. The caterpillar which emerges is brownish black and white when young. At a later stage it turns green with brown bands. It feeds on young leaves and tender shoots. The adult caterpillar pupates on the plant before becoming a butterfly.

CONTROL. Catch caterpillars with hand and drop in kerosenized water.

Mealy bugs. The adults are very destructive to a large number of trees and shrubs like mango, guava, peaches, plums, rose, palms, coleus, geranium etc. They suck the plant juice and the plant dies. This also promotes the growth of sooty mould (black growth of a fungus). The female adults do not have wings, and are larger in size. The male adults have wings and are gregarious. The female lays eggs in a mass like waxy or cottony cocoon. At the time of laying eggs, it migrates to the base of the tree and lays 300 to 400 eggs inside the soil 5 cm-15 cm (2-6 in.) deep. The eggs remain in soil over three to four months. The young ones soon after hatching crawl out of the soil and move along the stem and reach the tender parts. They are more common in warm and dry climate.

CONTROL. (a) Stir the soil around the plants often to expose the eggs to sun.

(b) Apply a soil insecticide, 5 per cent BHC dust round the tree at 1 tablespoonful per square metre.

(c) Apply sticky bands treated with insecticides round the tree to prevent the crawling insects.

(d) In case of severe infestation, spray the plant with 0.5 per cent Malathion, i.e. a teaspoonful in a litre of water for 10 m² area.

Cabbage butterfly. This is a serious pest on vegetables of cabbage family and also on succulent leafy vegetables. The moth is diamond black which lays a large number of yellow colour eggs on the undersurface of the leaves. The eggs hatch and small caterpillars crawl on the surface. They are whitish-brown and bore the leaves and feed on the young shoots. On cabbages, they burrow the leaves and enter inside. The butterfly causing this havoc is *Pieris brassicae nepalensis*.

CONTROL. (a) Destroy eggs; pick and destroy caterpillars. This is very effective.

(b) Spray with Malathion 0.05 per cent two or three times at an interval of 10-15 days when the infestation is severe. One litre of mixture for 10 m².

Cutworms. They are active in *rabi* crops in the plains and in *kharif* crops in the hills. They cut like the pair of scissors the tender parts of the plants 10 cm (4 in.) above the ground level and lodge the plants. They are usually active during nights and attack the seedlings. The adults are dark brown with reddish tinge. The moths remain hiding during day time under the leaves, cracks and crevices. The larvae get themselves buried in soil during the day time. They attack a variety of plants at a time.

CONTROL. Mix in the soil surface 5 per cent BHC. Flood the field with water

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adding a little kerosene oil to it.

Mango hoppers and other leaf hoppers. Hoppers are responsible for poor setting in mango. The infestation is easily recognised by the noise raised by the insects when the shoots are disturbed. They are small, greyish-brown, wedge-shaped insects. They suck the sap of the flowers, buds, young shoots, causing young fruits to fall. The sticky secretion aids the growth of sooty mould which gives blackish appearance to the leaves and flowers. They are most active when the flush of new leaves and flowers appear in January-March.

CONTROL. Spray Malathion 0.03 per cent or dust BHC 5 per cent early in spring. This is a very effective treatment. The same control method can be adopted for other leaf hopper pests also.

Mites. They are eight-legged animals found mostly on the underside of the leaves of vegetables, fruit trees, roses and other flowers, specially during the hot dry summer. Both young ones and adults are highly destructive. They suck the plant sap and make it dry up. They are not visible to the eye but they give away their presence by thin whitish cob-web like threads under which they move. The colour of the mites is usually brownish or reddish but some of them are light brown to whitish. Their population is considerably reduced with the onset of the monsoon.

CONTROL. (a) Clear water syringing is generally enough.

(b) Remove leaves on which the cob-web has been made.

Snails and slugs. They attack most of the vegetables and fruits. They can generally be hand-picked. The snail infestation in Dispur, Guwahati gardens was so heavy that hand-picking was not enough. A saline solution of 2 tablespoons of salt in one litre of water was found effective.

Nematodes. Nematodes or eelworms are tiny microscopic animals which inhabit generally in the root zone of the plants, and sometimes attack the shoots and flowers. The plants stop growing and die prematurely, or remain stunted. Quite often they form knots in roots and are commonly called as root-knot nematodes.

CONTROL. Do not grow the same group of plants in the same field year after year. In case of severe infection, inject into the soil any one of the nematicides like Thimet or Nemagon, two to three weeks before planting the crop. Nemagon can be used afterwards also.

Scale insects. This is a very severe pest on a number of fruits, vegetables and ornamental plants, including roses. The scale insects have special preference to the rose family. They are tiny, with minute sucking mouth parts with which they suck the cell sap. The tree bark gets covered with grey layer of overlapping scale like smallpox scales. By constant sucking of the cell sap, the infested twigs become dried. These insects can also infest the fruits. The female insect is capable of hatching eggs within its body. The young ones crawl for some time and get fixed in the tender parts of the plant and lose their legs. Thereafter they become sedentary. These insects are active during February-March and August-October.

PLANT PROTECTION

CONTROL. (a) Remove the infected part and destroy. In early stage, these insects can be removed by scraping with the help of a blunt knife or tooth brush. Application of methylated spirit can remove only minor infestation.

(b) For severe infestation, spray with Monocrotophos 0.05 per cent. It is sufficient to spray twice during the active period.

Thrips. This is a severe pest on chillies, grapes and flower plants. They are lice-like insects with fringed wings and are found mostly on the underside of leaves. They suck the plant sap and lacerate the tissues. The infested surface of the leaf or fruit becomes corky in appearance. Due to uneven growth of the tissues, the affected part becomes brittle. Fruit splitting is also caused by thrips attack. They are most active during the *kharif* season.

CONTROL. Spray with 0.1 per cent DDT, i.e. 1/4 teaspoonful in a litre of water.

White ants. They are also known as termites. They are polyphagous in nature and infest different types of crop plants as well as old wood. They differ very much from other types of ants in colour, morphological characters and habitat. They seldom come out to sunlight unlike the ants. The nests of the white ants are built very deep inside the soil where the queen lives. The white ants may or may not have wings depending upon the type of function they perform. They multiply rapidly during the rainy season and destroy the crop. Raw cowdung or compost is one of the factors attracting these ants.

CONTROL. Mix 5 per cent BHC (i.e. 1/2 teaspoonful dust per m²) in the soil 15 days before sowing the crop. If the fortnightly gap between the application of pesticide and sowing of crop is not given, it may affect germination of the crop.

Whitefly. They are small, sucking insects with floury wings; white and appear as if dusted with wax. The eggs are laid in a cluster on leaf surface and attached to a short stalk. They attack a number of crops like brinjals, *bhindis*, pears, chrysanthemum and hibiscus. They suck in large numbers the sap and cause wilting of the affected plants.

CONTROL. Spray the crops with Malathion 0.3 per cent.

DISEASES

Anthracnose. This is a kind of leaf and fruit spot formed on a number of fruits and vegetables, especially on bananas, mangoes, guavas, grapes, chillies and leafy vegetables. The spots are circular, slightly raised, concentric and are studded with a large number of raised black or crimson red bodies arranged in rings. The infection spreads rapidly under high humid conditions.

CONTROL. Spraying the fruits and leaves immediately after noticing the occurrence of the first symptom with either copper oxychloride 0.35 per cent (i.e. 1 teaspoonful in a litre of water) or Dithane Z-78 0.2 per cent or Dithane M-45 (i.e. $\frac{1}{2}$ teaspoonful in a litre of water) repeated at two to three weeks intervals depending on high humidity conditions controls the disease to a great extent.

*Blight*s (*Early and late*). The blights are most common in potatoes. The other

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vegetables as tomato and brinjal, and ornamental plants like dahlia and lily are affected by early blight only. The blights thrive in moist humid weather. They are caused by certain fungi. Symptoms of early blight are a number of concentric isolated spots, mostly dark brown, which develop on the underside of leaves and petals under high humidity conditions. A growth with ashy appearance is noticed. Late blight shows spots water-soaked, irregular and joined together causing rotting of major part of infected area and affected stems, and tubers also, besides leaves and petals.

Two types of blights of leaf occur on the potato. The early blight is severe in warmer areas while late blight mostly occurs in cooler climate. The late blight kills the entire plant in a severe case and also affects the tuber formation whereas the early blight forms severe leaf spotting but does not kill the plants. The tuber yield in both the cases is very much reduced.

CONTROL. The blights are kept under control by constant timely spray with Dithane M-45 0.2 per cent or Dithane Z-78 0.2 per cent or copper oxychloride (0.35 per cent). In potatoes, two or three sprays are normally required starting from 30-45 days after planting or before onset of monsoon, whichever is earlier.

Bunchy top of banana. This is an important banana disease caused by a virus which should be controlled at the initial stage. It spreads fast by planting infected suckers in healthy areas. The disease is recognised by the presence of short, lean and lanceolate leaves, crowded together and giving a bunchy appearance. Such plants seldom produce two bunches. They die prematurely.

CONTROL. Do not take suckers from infected areas. Always get certified suckers. Spray the plant with Malathion 0.05 per cent to kill the vectors.

Citrus canker. This disease is caused by bacteria and is very common in many citrus-growing areas. It is especially severe in limes and sour oranges. The pathogen forms cankerous, brown growth on the leaves, young stem and fruits. The leaves in case of severe infection dry up. The fruits, on storage, rot around the infected areas.

CONTROL. Prune severely affected twigs and leaves. Spray Agrimycin 0.02 per cent or Streptomycin sulphate (commercial) 0.02 per cent soon after the new leaves are formed. Two or three sprays at fortnightly intervals will control the infection.

Club root. This disease is common in cabbage and cauliflower, mostly in the higher elevations. This is caused by a fungal organism. The infection is revealed by the presence of nodules on roots giving a club-like appearance. The plant does not die immediately but remains stunted. The production of leaves and vegetable heads is very adversely affected.

CONTROL. The roots of the seedlings before transplanting should be dipped in 0.1 per cent mercuric chloride. This is marketed by different companies, with instructions for dilution, in the form of tablets which are coloured and are easy to handle. Alternatively, drench the soil with Dithane M-45 0.2 per cent.

Damping off of seedlings. This disease is caused by fungal organisms which are generally present in the soil. The seedlings raised in nurseries especially those with

addition of organic manure like farmyard manure, leaf mould, etc. facilitate the spread of infection. The symptoms are severe when the moisture content of the soil is high. The seedlings appear wilted in groups and they become flaccid within a day or two and finally they rot. The disease spreads very rapidly if adequate precautions to control it are not taken.

CONTROL. (a) Grow the nursery on a raised seedbed with good drainage.

(b) Sterilize the soil of the nursery bed by burning the trash. If this is not feasible, drench the soil with Dithane M-45 0.2 per cent.

(c) On noticing the first symptom of wilting, thoroughly drench the soil including the seedlings with the above-mentioned fungicide.

Die-back. This is common on fruits, especially citrus, and vegetables and on roses and geraniums. This disease is caused due to infection by certain fungal organisms at the root region. Sometimes such symptoms are also seen when the root strikes at the rocky subsoil. The symptoms are the drying up of the margin of the leaf, especially, the younger ones. The drying slowly spreads to young shoots in severe cases.

CONTROL. (a) Prune all the wilted and dry twigs 2–5 cm (1-2 in.) below the infected region. Apply at the cut ends a thick paste of copper oxychloride or Dithane Z-78.

(b) Give a general spray soon after a new flush is formed with Dithane Z-78 or copper oxychloride at the rate of 0.2 per cent and 0.35 per cent respectively.

(c) In case of root infection as seen from the advancement of die-back to the main stem, expose the roots at the bottom away from the main stem up to a depth of about three to four inches and apply lime or drench with copper oxychloride and cover the soil back.

Leaf spots. The disease is very common in a very large number of fruits, vegetables and ornamental plants. A number of fungi as well as bacteria cause leaf spots which vary in size, shape, colour and the extent of damage. They indirectly affect proper formation of fruits and flowers. The leafy vegetables become useless for consumption since they rot quickly. The symptoms depend upon the pathogen and vary from pinhead like, dark brown isolated irregular spots to large dark-brown concentric circles.

CONTROL. Spray with Bavistin 0.1 per cent or Dithane M-45 0.2 per cent or Dithane Z-78 0.2 per cent repeated two to three times at fortnightly intervals during the growth period.

Downy mildew. It is serious on grape vine, cucurbits and leafy vegetables. The infection is seen as fluffy white growth mostly on the lower surface. It does not cause immediate death of the affected parts. In the case of grapevines, the damage is severe on inflorescence and growing stems which become distorted, swollen and dry up.

CONTROL. Spray periodically as for leaf spots starting from the first appearance of the disease. Both the surfaces of the plants should be covered with the fungicide.

Powdery mildew. This is the common malady specially on rose, carnation, chrysanthemum, dahlia, cucurbits, peas and citrus plants, during the dry cool weather

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and when the plants produce new flush. They are easily recognised by the presence of scattered areas showing powdery growth mostly on the upper surface of the younger leaves. The infection results in curling of the leaves and sometimes premature defoliation. In case of severe infection the entire surface of the leaf get covered with powdery growth. The powdery growth can also be seen on the young buds which arrests their opening.

CONTROL. Spray with Bavistin 0.2 per cent.

Rots and wilts. This is a common malady in irrigated, low-lying areas. A number of vegetables, fruit trees and ornamental plants are affected. This is caused by more than one kind of fungal organism. The first symptom is observed at the tip of the leaves and young shoots which become yellow and then turn brown. The tip dries up and the young shoot shows wilting. This progresses rapidly depending upon the weather conditions leading to death of the plant. In root rot, on uprooting the wilted plants, the decay of the skin of the roots and softness of the smaller roots can be noticed.

CONTROL. Treatment should be done well in advance of wilting. Soon after noticing the first symptom of tip wilting and drying, watering should be reduced. Drainage should be checked and improved. About 7-10 cm (3-4 in.) of the soil around fruit trees should be dug out and the larger roots exposed for aeration. The soil is then drenched with Dithane M-45 0.2 per cent. In case of vegetables and shrubs the root portion is drenched without removal of earth.

Bud rot of palms. This is a severe disease of coconut, arecanut and other ornamental palms along the coastal areas especially during the monsoon months. The central growing shoot is affected by the fungus causing it to rot. Infection year after year of the same palm leads to complete destruction of the tree.

CONTROL. Scoop out all the infected areas and apply paste of copper oxychloride. Spray the crown with Dithane M-45 0.2 per cent twice during the monsoon season.

Fruit rots. The ripe fruits are subject to infection by a number of pathogens, especially when they are subjected to wounds. The symptoms vary with the type of fungal organisms involved in rotting. Generally they give a water-soaked appearance in the beginning and then spread, sometimes, to the entire fruit region. Once the infection starts it is difficult to control. Such fruits are to be consumed or removed from the rest of the healthy ones if badly infected. They should not be used in the preparation of canned fruits or juices and jellies, etc.

CONTROL. Avoid injury to the fruits soon after harvest. Store in well-ventilated rooms. The racks etc., used in the store, should be periodically cleaned with a disinfectant like Dettol. No damaged fruit should be stored along with the healthy ones.

Rust. This disease is common in peach, plum and flower plants such as geranium, *Chrysanthemum* and carnation, in cooler regions. This could be easily identified by the presence of powdery mass of brownish to reddish-brown spores of the fungus. The severely affected plants dry up and premature leaf fall is very common.

CONTROL. Spray with Bavistin 0.1 per cent or Dithane M-45.

Apple scab. This is caused by a fungal organism and the spots are formed on the leaves, young and immature fruits as well as the shoots. The spots are light to dark brown, circular and cause dry-up of the infected areas. Cankorous growth is formed on the fruit and causes irregular growth. The quality is very much affected.

CONTROL. The fungus should be controlled well before it spreads to the fruit by spraying with Dithane Z-78 0.2 per cent or Captan 0.1 per cent on leaves and young fruits.

Virus diseases. There are some important virus diseases affecting the vegetables, like *bhindi*, tomato, etc. They are commonly called as leaf curl, yellow vein mosaic, etc.

CONTROL. Generally there are no direct measures for the control of virus diseases. However, precautions should be taken to keep away insects which act as carriers for viruses under control by spraying with suitable insecticide well before the spread of the disease. Some examples of vectors for virus diseases are white flies on *bhindi* for yellow-vein mosaic; aphids on tomato for leaf curl; and hoppers on brinjal for small leaf. Once a disease spreads, it is difficult to control. To avoid spread of the disease, it is better to pull out such of the plants which exhibit severe symptoms of virus and destroy. Use virus-resistant or tolerant varieties, as far as possible.

5

LAWNS AND HEDGES

LAWNS

A lawn is an inseparable part of a good home garden. It provides a natural setting for the growing flowers and shrubs like a canvas for painting a picture. It is cool and refreshing in summer and pleasant and relaxing in winter. A lunch on the lawn in winter and dinner on a full moon night is like a picnic.

A lawn is a permanent feature and, therefore, good care should be taken in preparing it. It may be difficult to rectify later any mistakes or negligence in initial preparation. The grass used for making a lawn is a cultivated plant, and requires attention as much as any other plant.

Shape of a lawn. The shape of a lawn may be regular or irregular. The most popular regular shape is rectangular. An irregular shape will be more difficult to maintain and will require superior artistic judgement for providing a natural and beautiful setting. A rectangular lawn may not look so formal if the herbaceous or mixed border, into which it merges, has been given an irregular shape. An irregular shape, unequal in length and breadth, with no pointed corners and not too many curves, is very effective, if carefully surrounded by flower borders, trees or rockery. Advantage may be taken of the existing natural features. The lawn may follow the graceful curves of the slopes, if any. In the hills, a portion may be converted into lawn by making a terrace and the remaining area may be allowed to retain its natural slope.

Essentials of a good lawn. Essentials of a good lawn are that the grass should be thick, of good green colour, without any weeds. It should have trim edges and the land should be even. It should give the feel of a green carpet when walked upon.

Weeds are a great nuisance in a lawn and weeding is a continuous process. Normally a home garden can be managed without a weedicide if the initial preparation is good. The Indian nut grass (*Cyperus rotundus*) is a very tenacious and common weed and

is difficult to eradicate. The roots of this weed go as deep as 90 cm (3 ft). The weed roots should be removed after deep digging at the time of preparation of the soil for the lawn.

The soil up to a depth of 2 spits should be dug. Any big stones should be removed. Smaller stones below the level of 7-8 cm (3 in.) should not be removed as they provide necessary drainage and make the soil porous. They also keep the soil cool. If the soil is very heavy with poor drainage, it may be dug up to another spit and the bottom layer may be filled with stones, clinkers, leaves, etc. For big lawns, which have poor drainage, pipes may have to be laid. This will, however, require expert advice.

Divide the area roughly into one square metre blocks by tying ropes at suitable intervals with twine knotted on the sticks. Take 5 kg of farmyard manure, 5 kg of leaf mould, 250 g of bone-meal for one square metre area and mix with equal quantity of river sand for clayey soil. Spread it even near the surface, not more than 15 cm (6 in.) deep (because lawn grass has shallow roots) and mix with the soil. Press lightly with a light roller. If a roller is not available, press the soil with a spade or wooden mallet.

Methods of lawn-making. Common methods of making a lawn are dibbling grass roots, sowing seed and turfing. Soil preparation for all these methods is the same. The method most commonly practised in India is dibbling. Roots of the selected grass are inserted into the soil, i.e. dibbled at a distance of 10-15 cm (4-6 in.) in the beginning of the rainy season and they spread themselves to cover the whole area in about 3-4 months.

Preparation of a lawn by sowing seeds is the cheapest, but dibbling of grass roots makes a lawn in a shorter period without any risk.

In making a lawn from seed, the risks are that the life of the seed is short, birds and ants are very partial to them and they might get washed off to one side due to heavy rain. Proper levelling of land, precautions against birds and ants and proper watering are the controls for these.

Seed required will be about 500 g for 200 m² (1 lb for 250 yd²). Divide the site into convenient blocks and measure the quantity required for each block. Mix seed with twice the quantity of sand. Broadcast it evenly over the patch and then lightly rake over each patch. Grass seed should never be sown deep. As the seed is very thin, it should not be broadcast on a windy day. Smoothen the sown area with the back of the rake. It takes about 15-30 days for the seeds to germinate and about another six months for the roots to spread and cover the entire ground.

A turf means a piece of earth surface thickly filled with rooted grass. In turfing, fairly long strips of earth with roots of the grass intact are cut and set on the soil. Grass roots removed in small blocks are also used to develop a lawn in a short time to fill up a patch in the lawn. Turves are not being sold in this country. But where they are available, it is recommended that at least 10 per cent more should be ordered to cover any loss or breakage.

Before dibbling or turfing, weed-roots, if any, should be removed. Begin from one side and lay the turves as you lay bricks, so that the joints of two rows of turves are in the middle of the next one. If this is not followed, a crack may develop at the joint. Work

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from one side, standing on a wooden plank laid on the part already turfed. The turves should be beaten in line; they are not damaged or harmed by doing so. Beating should be done with a wooden mallet. After turving is complete, brush the soil into the crevices between the turves and put the roller lightly over the surface. It takes about 2-3 months for the roots to cover the whole ground. This is the quickest method, but not the most economical if turves are purchased. Turves in small blocks can also be obtained from the wasteland or the jungles.

Plastering with grass is also recommended by some and I tried it in Shillong. The result was not as good as with dibbling. Grass runners may be chopped about 3-5 cm ($1\frac{1}{2}$ -2 in.) in length, mixed in the proportion of two parts of roots and one part of farmyard manure. Add water so as to make a mud plaster and spread evenly over the soil. It will take about 15 days for the roots to develop. The rest of the process will be as for dibbling.

Levelling. Levelling is very essential for a lawn. One of the easily practised and recommended methods is to check the level with the help of a spirit level and by inserting wooden pegs of uniform height as markers. The wooden pegs are about 30 cm (12 in.) high with a mark at 15 cm (6 in.) from the top. Put the spirit level at the point which may be likely to be the even level of the lawn. Drive the first peg into the centre of the lawn and test it with the straight edge and spirit level. Drive the second peg at a distance of about 2.5 metres (8 ft) from the first peg. Proceed thus all over the place. 15 cm (6 in.) mark of the peg will be above or below the surface. Where the marks are above, soil is to be filled; where they are below, soil is to be removed.

A rough and ready method normally followed in Indian gardens is the use of a wooden plank about 15 cm broad and 60 cm (2 ft) long with a handle or with rope tied at both the ends and pulled from one side to another. Eye estimation is the only way of judging in such a method and this practice is fraught with drawbacks.

Mowing. For making a good lawn and maintaining it, mowing is the most important operation. It keeps the grass trim and checks weed growth. Coarse grasses and weeds do not like to be mowed. They gradually become weaker if frequently mown. It is advisable to be very careful with the first mowing. Grass should be 7-10 cm (3-4 in.)

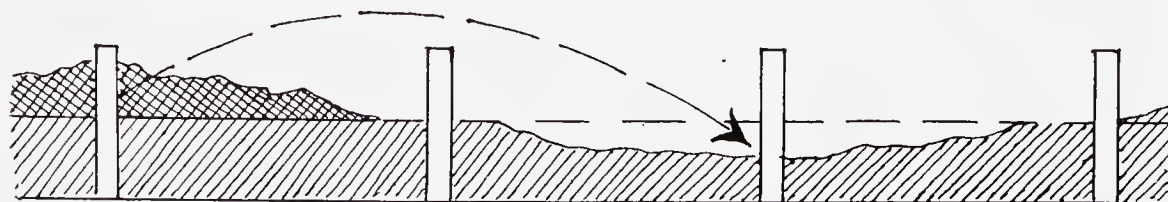


Fig. 12. Lawn making pegging and levelling

high and should have established itself well. The first mowing should preferably be with a hand scythe. If this is not possible, mowing may be done with the mowing machine, keeping the blades high; it should be done gently and with a very sharp blade, otherwise it might unsettle some of the tender roots.

The second mowing should be done at about the same height in another 3-4 days. Gradually the grass will thicken and spread out. The first year is a crucial period for lawn-making and the lawn should be mowed twice a week. Once the lawn is well made, mowing may be done once a week. A well-kept lawn may not look attractive, if its edges are not trimmed. The lawn edges must be neat. An edge-cutter is helpful for this. If the lawn mowings are very fine, they can be left on the lawn. If they are not fine, they should be collected from the lawn and deposited in the compost pit or used for mulching, otherwise the lawn may get spoiled due to decay of the lawn mowings.

Keep your broom busy to keep the lawn clean, particularly in autumn in the hills and at the end of spring in the plains, after the leaf-fall. The decaying leaves spoil the lawn. Aerating the soil with a garden fork checks the pests and diseases and stimulates the growth. A green slime-like substance forms in the lawn where there are wet patches. This can be controlled in most of the cases by improving drainage and sprinkling with sand. In acidic soils, generally in the hills, a sprinkling or crushed limestone is helpful.

Scraping and raking. Due to constant rolling and mowing the soil sometimes forms a hard crust on the surface and the lower part of the grass becomes matted or woody. The lawn then needs to be scraped and raked. The entire lawn should be scraped with a *khurpi* followed by raking before the break of monsoons, i.e., in the months of May-June in the northern plains and in March-April in the hills. But in other cases where the condition of lawn is good, thorough raking only both ways will be sufficient to take out old runners and aerate soil. Then mow the grass until the old stumps of grass are well trimmed and the surface of the lawn cleaned and exposed to the sun. The lawn at this moment may appear tragic, but will develop much healthier and smoother growth later.

Manuring. A top-dressing of garden soil, and leaf mould in equal proportions is beneficial. For clayey soil, sand in equal quantity should be added to the mixture. One hundred kg of the mixture is sufficient for an area of 100 m². Bone-meal 0.1 kg per 10 m² should also be applied. The lawn should be rolled after top-dressing. This should be repeated in September.

Ammonium sulphate at 1 kg for 100 m² applied every month from October-November to February-March gives a lush green lawn with thick growth. The concentration may be 1/2 tablespoonful in 1 litre of water. It may preferably be applied as a liquid manure

Moss and earthworm eradication. In moss-infested lawns, potassium permanganate @ about 30 g per 5 litres of water per square metre (one oz per gallon of water per square yard) is reported to be helpful. Application should be immediately after mowing. Two such applications at an interval of fifteen days are recommended for heavy moss infestation. Earthworms enrich the soil and I would not like to eradicate them from the

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lawn. If, however, it is decided to eradicate them, a solution of half the strength is recommended. After application, earthworms wriggle to the surface and should be swept off. Field rats can also be a nuisance to the lawns.

Lawn grasses. Doob or Bermuda grass (*Cynodon dactylon*) is the most popular lawn grass in the plains. It is soft, dark green, vigorous and of trailing habit. It is shallow-rooted and, therefore, needs frequent watering. It is slow in germination which takes about 2-4 weeks. It does not do so well in the hills. Another grass recommended for the plains is *Jocia japonica*. For the hills the grass recommended is *Lolium perenne*. I could not get this grass, but tried the doob. It required continuous weeding, but the effect was quite good.

HEDGES

A hedge is a series of a plant grown in a straight line or a smooth curve to serve as a barrier or screen. It provides a natural background to a garden, like a frame to a picture. It may be external or internal. An external hedge is tall and may replace the compound wall. It also serves as a wind protection. It may be 1.5-2.5 m (5-9 ft) high. The internal hedge would separate one part of the garden from the others and is not so tall. It may vary from 30 to 90 cm (1 to 3 ft). Hedges may be of deciduous or evergreen plants. They may be of flowering plants also. Where a hedge is required immediately as a screen, or wind-break, it should be quick growing, tall and evergreen.

Essentials of a good hedge. The essentials of a good hedge are that it should be thick and dense; it should have foliage from the bottom to top; it should be trim and neat; if it is a flowering hedge its bloom should not clash with the general colour scheme.

To achieve a shapely, attractive hedge, fulfilling its role, the following cultivation practices are recommended:

(a) Soil must be dug at least two spits deep and 60 cm (2 ft) wide. In case of tall hedges of 2.7 m (9 ft), the soil may be dug 3-spits deep and 90 cm (3 ft) wide. It should be well-drained. The soil mixture should be rich with organic manure and leaf mould. Top-dressing of bonemeal is helpful. Deep placement of manure encourages deep growth of roots which allow hedge plants to grow erect and vigorous.

(b) Soil must be enriched annually by adding organic manure and bonemeal.

(c) If placed along the fencing, it should be at a distance of at least 45 cm (18 in.) from it, to provide room for its side growth.

(d) It must be planted closely, subject to cost limitations. A double hedge, in which the plants are staggered diagonally, is preferable to a single rowed one. Plant 20 per cent extra cuttings or retain extra seedlings in a corner for replacement. I prefer a spacing of 15-20 cm (6-8 in.) for cuttings and 20-30 cm (8-12 in.) for rooted plants. I grew a *Duranta* hedge with cuttings with this spacing and got a uniform compact effect in Guwahati.

(e) Frequent pruning prevents the hedge from becoming thin and woody.

Frequent light pruning is better than hard pruning done seldom. In the growing season, it may be necessary to clip it at least 3-4 times. Till full growth is reached, pruning is mainly for encouraging bushy growth. After it attains the desired height, pruning is mainly for shape. The type and frequency of pruning will depend on variety. A fast-growing variety needs more frequent and hard pruning than slow-growing ones. Do not prune until plants are well established.

Detailed notes on the shrubs suitable as hedge plants is given in Chapter 10. My favourites are *Murraya exotica* for the plains and *Cupressus macrocarpa* for the hills. I maintained the hedge of *Pithecelobium dulce* in Guwahati and was impressed by its neat and compact habit and attractive foliage. One of the fastest-growing hedges is of *Putranjiva*. *Duranta* is suitable for the hills as well as the plains. Some of the select ones are discussed here.

Foliage plants as hedges. Some of the most common foliage hedges are *Acalypha* with its copper-red leaves, shining beautifully in winter months of December-January when there are very few flowers; it is suitable for a medium hedge; *Clerodendron inerme* an evergreen drought-resistant plant used frequently by the roadside, is not eaten by cattle or goats, and is suitable for a low to medium hedge; *Cupressus macrocarpa* with its neat thick, flexible growth, suitable for the hills — an excellent hedge; *Cupressus orientalis* with its neat, thick and attractive hedge in the northern plains; *Duranta* is also an evergreen drought-resistant fast-growing plant with very neat habit and bright green foliage, suitable as a medium hedge; *Dodonea viscosa* with its evergreen narrow shining leaves suitable as a medium hedge; *Pithecelobium dulce* (*vilayati imli*), formerly known as *Inga dulce* with its thorny stems and small feathery leaves making an impregnable medium to tall hedge; *Lawsonia alba* (*mehndi*) with its pretty small bright green leaves which look prettier at the beginning of the rains when the flush of new leaves comes out, is suitable as a low to medium hedge; *Murraya exotica* with its small dark green leaves and growth as compact as one desires and adaptability to any shape, is suitable for any size of hedge.

Flowering plants as hedges. There is a large variety of flowering plants which can be used as hedges. The most prominent of these is the *Bougainvillea*. A variety like 'Thimma' or 'Dr Rao', or 'Louise Wathen Variegated' gives pretty bloom as well as beautiful variegated leaves.

The other common flowering hedges are *Beloperone amherstia* with the perpetual rust-coloured bracts overlapping small white flowers; *Bougainvillea* allowed to overflow the walls and not clipped; *Buddleia asiatica* with grey-green foliage and conical fragrant clusters of off-white flowers; *Hamelia patens* with red-veined leaves like *Fuchsia* and attractive orange-coloured flowers in the rainy season; *Hibiscus* with its trumpet-like bright flowers of orange, pink, white, red, purple, etc., with dark green bright foliage; *Jatropha* with its star-like rose-crimson flowers; *Lantana* with its compact dark-green foliage and round cluster of flowers; *Lonicera japonica* (honeysuckle) with beautiful fragrant white flowers and small dark-green leaves; *Plumbago* with pearl blue flowers;

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pomegranate with tiny leaves and bright scarlet flowers; *Putranjiva* with its attractive dark green foliage and versatile habit; *Tabernaemontana coronaria* with star-like pure-white flowers, decorating dark-green shining leaves; and *Tecoma stans* with bright yellow trumpet-like flowers.

Perhaps the only hedge of an edible fruit and one of the prettiest is of *karonda* (*Carissa carandas*). It has dark-green, thick foliage of small leaves and is thorny. It can be from a medium to a tall hedge. I saw a very beautiful hedge up to 2 m (7 ft). It would bear lovely berry-like oval fruits in June-July preceded by fragrant white flowers, if pruning could be avoided for some time before flowering.

In the hills, Rambler roses, fuchsia, holly and heliotrope can also be used as beautiful hedges. *Buddleia asiatica* can be replaced by the prettier *B. lindleyana* with its compact conical clusters of violet-mauve or purple flowers.

Plant edgings. Plant edgings are no longer popular as they are difficult to maintain. But if any gardener is fond of it, *Alternanthera* with its bicolour leaves — green with a tinge of bronze-orange, which become smaller in winter — makes very attractive and neat edging. It is also effectively used for 'lettering' or carpet bedding. In the hills of Ootacamund, I saw a very attractive edging plant namely *Santolina chamaecyparissus*, which can also be used as a low hedge of only 7-10 cm (3-4 in.) or medium hedge 30-45 cm (1-1½ ft). It has silver-grey downy foliage with tiny bright yellow globular button-like flowers. It is quick growing and can be propagated from cuttings.

Topiary. The art of shaping a hedge in ornamental forms and figures is known as 'topiary'. The figures generally chosen are of animals, but sometimes human figures are also selected. Sometimes even a theme is depicted like a farmer with a pair of bullocks. It is an interesting garden feature but needs a lot of labour in training the plant and thereafter maintaining it. The training is done with the help of stakes, nails and wires. Continuous pruning is required. The plant selected should be capable of being moulded to such shapes. *Murraya exotica* for the plains and *Cupressus macrocarpa* for the hills are found to be excellent for this. Box or yew is also reported to be excellent in the hills. I have seen *Clerodendron inerme* also used for this purpose but it was not so attractive.

6

FLOWERS, HERBACEOUS BORDER AND ANNUALS

FLOWERS

THE flowers — colourful and fragrant, exude the joy of life. They may be annuals, i.e. raised every year from seed, completing their life cycle within a year; biennials which produce flowers, seed and perish, in two years; and perennials which once planted continue to grow for a number of years.

HERBACEOUS BORDER

In European books a herbaceous border means a border of perennial flowers. It now includes bulbs also. In India, in the plains, the flowers which are perennial in the hills can be grown only as annuals during the winter. A herb according to Webster, is “a seed-producing annual, biennial or perennial that does not develop persistent woody tissue but dies down at the end of a growing season”. Therefore, a herbaceous border has been used here to mean a border of annual, biennial, perennial or a mixture of such flowers and bulbs.

Guiding principles. The border should have a background — a hedge, shrubbery or a wall with a creeper harmonising with the general colour scheme of the garden. Honeysuckle and ivy would be good creepers for a background while *Murraya exotica* with its small dark-green leaves would be excellent as a background hedge.

The objective is to create maximum effect by proper arrangement. The plants should, therefore, be arranged in clusters and not in small bits dotted here and there.

In a herbaceous border different types of annuals, biennials and perennials showing variations in height and colour are grown. In the plains of India, however, the

herbaceous border comprises only annuals. When one or more types are grown in a small plot, it is often called a 'bed'. A herbaceous border may be of a single or multi-colour of different groups of plants. It should be broad enough to be effective. A few plants in narrow borders look like museum pieces.

In a herbaceous border, particularly with annuals, it is desirable that the different types of blooms are at their best at the same time for the longest period. On the other hand, some prefer to have a succession of blooms over the longest possible period. The period and duration of blooming of each variety should, therefore, be known. In such an arrangement, later flowering plants may be at the back and early flowering ones in the front.

The arrangement of taller plants at the back and shorter in the front is a common one. Some other interesting arrangement can be short plants at the sides, gradually increasing and leading to the tallest at the centre. A cluster of tall plants in the middle of the short ones may help in breaking its monotony. The focal point of the border may be away from the centre and thus an eye catching asymmetrical pattern may emerge.

One can play imaginatively with colours. Borders may be of one colour with different shades, or a few selected colours or a mass of mixed colours. In any such arrangement, colour matching and clashing should be kept in view. The best guides are colour combinations in nature. A group of multi-coloured pinks or pansies gives most wonderful colour combinations in nature.

Lighter or softer colours may be at the end gradually coming to darker bright ones at the focal point or the darker ones may be at the end gradually coming to the lighter ones at that point. The former will make the bed look closer and the latter may lend it distance. Besides personal preference, the choice may depend on the size and shape of the bed and the effect proposed.

Shades of a colour placed together with darker ones at the back and lighter in the front, may give an unusually attractive colour scheme. A very pretty and fragrant combination is sweet peas, stocks and sweet alyssum in shades of pink. Another attractive combination is Canterbury Bells with *Ageratum* or *Godetia* with sweet alyssum.

Placing of darker shades next to softer ones is safer than placing them next to contrasting darker colours which can create unpleasant colour clashing. Judgement of colours and shades, therefore, has to be sound. Strong yellow looks well with bronze like marigold and mimulus. Red or scarlet may be placed with white, for example red salvia with white *Bellis* or Shasta daisy, the indigo-purple or violet of larkspur with the yellow of Californian poppy or of calendula, the rose of clarkia with the white of candytuft or the pink of *Acroclinium* with white of sweet alyssum. Darker shades of blue give an impression of distance and may be placed accordingly.

The foliage of plants is equally important. Plants with feathery leaves provide relief to broad-leaf plants; e.g., lady's lace with hollyhock. Plants with erect leaves next to roundish leaves make a happy combination, e.g., gladioli with violas. Dark glossy

8. *Bellis*



9. Lady's lace (*Pimpinella monoica*),
excellent for flower arrangement





10. Sweet alyssum



11. *Primula malacoides*

FLOWERS, HERBACEOUS BORDER AND ANNUALS

green leaves with grey or light colour leaves would also be pleasant contrast, e.g. *Begonia semperflorens* with grey-green foliage of carnation or *Cineraria maritima*.

The shapes of the blooms are also an important consideration. The featheriness of white gypsophila looks beautiful with the round heads of pink *Acroclinium*. Spiky tall blooms of delphinium contrast well with the funnel shape of the bright orange *Eschscholzia*. Erectness of foxgloves with sprawling white of sweet alyssum, roundness of dahlias with conical shape of *Celosia plumosa*, white cylindrical candytuft with bright red salvia, are some of the examples of pleasing contrasts.

Even if an initial mistake is made in the colour scheme or combination of foliage or arrangement of plants, it can be rectified next time. One need not try to make so much fuss or study that the joy of making the herbaceous border is lost. It is, however, advisable to draw the plan on a graph paper and visualize it before it is put into practice in the ground.

ANNUALS

The most popular type of flowers in home gardens in India is annuals, i.e., those which are raised from seed, grow, bloom, seed and exhaust themselves during a season. It has the advantage of tremendous variety of colour, size and form. It occupies garden space for less time and can be easily replaced. It is cheap and can be easily raised from seed. This is the only group which allows the gardener to see all the stages of growth in the shortest possible period, and thus satisfies the 'growth instinct' of gardener more than any other type.

There can be as many uses of the annuals as there are gardeners. Annuals may be grown in beds, herbaceous borders, as an edging, for screening (climbing types), covering bare walls or slopes, for window boxes, pots, etc.

Besides the well-known and well-established varieties, it is worthwhile trying a few new varieties every year. This can afford many interesting surprises. One of them, worth mentioning which I had thus picked up is the *Camellia*-flowered balsam, a deep rose-coloured variety of annual balsam with double compact flowers like miniature *Camellia* blooms attractively growing on both sides of the stem. If all the lateral branches are cut, the concentration of the flowers on the single central stem is most attractive. The annuals are normally grown in borders or beds, but an unusual method is to throw a few seeds at random and let them give the thrill of a wild garden. I once saw a beautiful mass of pink *Acroclinium* against the background of a palm (*Livistona chinensis*).

Essentials of cultivation. The essentials for annuals are as follows:

- (a) Provide an open sunny position; the exception is *Cineraria*, *Salvia*, petunia and larkspur do not mind semi-shade.
- (b) Good drainage is very essential.
- (c) Soil should be reasonably fed with organic manure but avoid overfeeding.

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Overfeeding may result in excess leafy growth and less of flowers. Nasturtium gives its best on poor soil.

(d) Should be grown in herbaceous border for mass effect as already discussed.

(e) Staking would be necessary for all tall plants.

(f) More frequent watering is required as roots are not generally deep. Sweet peas, however, have very deep roots.

(g) General cultural operations, as already discussed, would be applicable.

Stopping of annuals. Stopping of young plants is an important cultural operation for the annuals as explained earlier. It gives a more compact plant which blooms over a longer period. No stopping is necessary where you would like to have tall, erect main stems with flowers on either side. In such cases, any growth of side shoots from the axil of the leaves should be rubbed off. Stopping can be adopted usefully in most of the annuals. Examples of those for which stopping may be done are antirrhinum, clarkia, godetia, phlox, salvia, zinnia, etc., whereas examples of the other category are larkspur, double balsam and double-stocks.

Annuals for edgings. Some of the annuals suitable and popular for edgings are ageratum, alyssum, forget-me-not (*Myosotis*), linaria, marigold (French), mesembryanthemum, mignonette, mimulus, nasturtium, portulaca, *Tagetes signata pumila*, virginian stock and perennial zinnia (*Z. linearis*).

Annuals for the plains and hills. In the plains most of the beautiful annuals can be grown only in winter. Some of those which are biennial or perennial in the hills are annuals in the plains or do not thrive. The annuals cultivated in summer and the rains and in winter for the plains and the annuals as well as biennials and perennials for the hills during the summer and winter are given below. The classification for the hills is based on the consideration that the area is not snow-bound in winter. In the latter case, all the plants shown as winter flowering will be grown in summer in the open or in winter in the hot-house.

In the plains, the varieties for summer and rainy season are the same. The seeds of summer season plants are sown in March-April and of rainy season in June-July with the onset of the monsoons. In winter they are sown in October-November, with the beginning of autumn. In the hills, the seeds of summer flowering plants are sown in February-March as the weather warms up after the winter. The seeds of winter flowering annuals are sown in September-October. In the hills a sturdy seedling should be in the ground before the winter frost sets in. The seedlings almost hibernate during the very cold months of December and January and start growing as soon as the spring sets in.

Plains

Summer and rainy season

Balsam
Cleome

Marigold
Portulaca

FLOWERS, HERBACEOUS BORDER AND ANNUALS

| | |
|------------|-----------|
| Coleus | Sunflower |
| Gaillardia | Torenia |
| Gomphrena | Zinnia |
| Kochia | |

All others would grow in winter in the plains. Marigold grows throughout the year.

Hills

Summer

| | |
|---------------|------------|
| Amaranthus | Gaillardia |
| Aster | Gomphrena |
| Balsam | Kochia |
| Chrysanthemum | Marigold |
| (Annual) | Salvia |
| Cleome | Sunflower |
| Coleus | Torenia |
| Cosmos | Zinnia |

All others would grow in winter in the open in the areas which are not snow-bound.

SWEET PEAS

Of all the annuals, the sweet pea is unique in its exquisite beauty and fragrance as well as requirements and can, therefore, justify a special corner to itself. It is a vine and can grow up to about $2\frac{1}{2}$ m (8 ft). Its height lends itself to providing a backdrop for a herbaceous border. The sweet peas need a very well dug soil up to a depth of three spits, i.e. about 70 cm ($2\frac{1}{4}$ ft). It should be richly manured with plenty of leaf mould and cowdung manure. It is particular about a sunny position preferably north to south in the hills and good water drainage. It is most susceptible to water-logging.

After the soil is well-prepared, water the bed on the previous night. Plant the seeds when the soil is moist. The depth of the seeds may be 1 cm ($\frac{1}{2}$ in.). The distance of seeds may be 10 cm (4 in.) from each other in a triangular pattern in two rows with a distance of 25 cm (9 in.) between the rows. Two such sets of rows will suffice in a row of 60 cm (2 ft) width. Cover the seeds with straw or small-meshed chicken wire to prevent the birds eating up the seeds. In the hills avoid watering till the seeds germinate. But under New Delhi conditions the soil is apt to become too dry and may need light watering, just enough to moisten it.

Pinch off the top 1 cm ($\frac{1}{2}$ in.) of the plant when it is 10-15 cm (4-6 in.) or has about three pairs of leaves. Thereafter the plant may be trained on the single stem system known as 'Cordon' system in which only one stem is allowed to be developed and all the

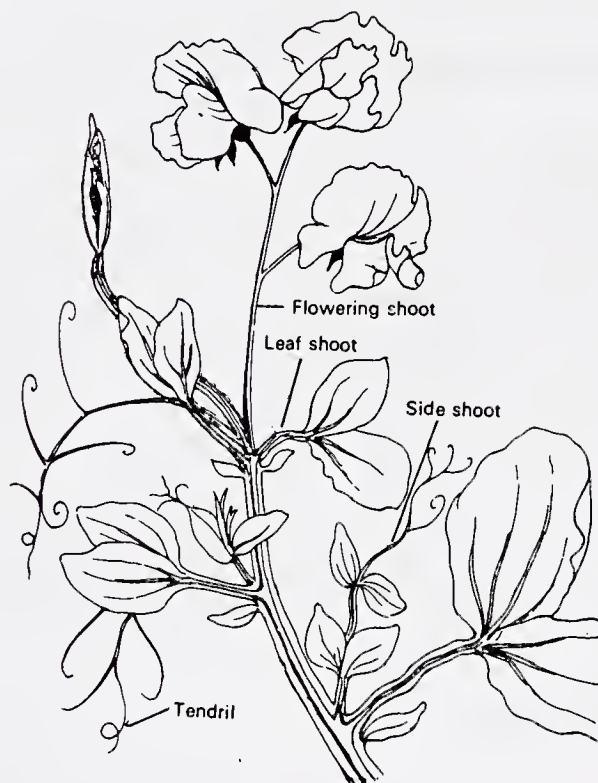


Fig. 13. Sweet peas

axil leaves cut and tendrils are removed; or as a multi-stem system. Remove all flower stalks until the plant is 60 cm (2 ft) high.

The main advantage of the single-stem system is that the plant really produces exhibition blooms. I saw such plants in the Indian Institute of Technology, New Delhi. I was informed that all axil leaf growth and tendrils were removed. The flower spikes were also removed till 28 days before the show. One flower spike would contain as many as 16-18 flowers almost all open at the same time. I was informed that in Delhi, only the early blooms set seed and later blooms do not set seed due to heat. The seed was imported from Australia. The plants were very tall but the growth was sparse, and the total effect was not as pretty as it should be. Perhaps, this was because the winter in New Delhi is short. This system should do better in the hills. I tried it in Shillong but found that the job of removing the unnecessary parts was very tedious.

The plants overtook the labour input. I thus arrived at the middle system of removing some of the axil growth and tendrils and letting the plants grow with multiple but restricted number of stems. The method worked well and the plants gave numerous flower heads over a period of more than six weeks with 3-4 flowers on each stem. The plants were as tall as 2.5 m (8 ft). Dwarf varieties which grow up to 60-90 cm (2-3 ft) are now available.

Liquid cowdung manure once a week is helpful after the plant is well established. It is important to remove all faded and dead flowers and seed pods, if any, not required for seed.

Sweet peas, though prone to pests like green flies, birds, slugs and snails, are remarkably free of diseases. Sometimes buds drop due to excessive moisture in the atmosphere or soil. This stops as these conditions change.

I grew a few sweet peas in leaf cups and planted them with the cups to fill up the gaps and also to give the lead time of about 21 days, when the bed is not vacant.



12. *Calceolaria*



13. *Clianthus puniceus*

14. *Calendula*



15. *Cineraria*





16. Gazania



17. Gerbera

18. Pansy



FLOWERS, HERBACEOUS BORDER AND ANNUALS

SELECT LIST OF ANNUALS, BIENNIALS AND PERENNIALS

| Name and description | Height/Distance/ Time taken for blooming from sowing | Colour and form of blooms |
|---|---|--|
| 1 | 2 | 3 |
| <i>Acroclinium</i> | | |
| A paper-like flower similar in texture to <i>Helichrysum</i> , it is popular for its delicate colour, profusion of bloom and ever-lasting quality of flowers. | H. 37-45 cm D. 37-45 cm T. 6-8 weeks | Bright rose-coloured round flowers borne singly on numerous stems. Variety with white flowers not so pretty. |
| <i>Ageratum</i> | | |
| Growing abundantly as wild flower, it is not attractive as its tiny flowers get lost in mass of leaves. Recent introductions of compact dwarf bush with numerous pretty tiny powderpuff-like flowers look pretty; a good edging or pot plant. | H. 25 cm D. 25 cm T. 8-10 weeks | Blue-mauve most common. Crimson and pale-salmon pink available abroad. |
| <i>Alyssum</i> | | |
| Very fragrant, excellent edging plant with mass of tiny flower heads and its neat compact habit. Excellent in borders, hanging baskets and also around shrubs and in rockeries. If it is cut back before it seeds, it blooms again. Does equally well <i>in situ</i> or on transplanting. | H. 10-15 cm D. 10-15 cm T. 6-8 weeks | White, mauve-pink, lilac. |
| <i>Amaranthus</i> (Love-lies-bleeding) | | |
| Ornamental as foliage and flower plant. <i>A. caudatus</i> has catkin-like drooping flowers of brick-red colour. <i>A. tricolor</i> has most striking leaves at the top in crimson and yellow. | H. 1/2-1 m D. 50-70 cm T. 12 weeks | |
| <i>Anchusa</i> | | |
| Thick stems with a large number of tubular-shaped flowers on both sides of stems. Blooms better at higher elevations. Propagation can be from root division or root cuttings, besides from seed in the autumn or spring. Does not grow in South India. In North India, cultivated as an annual during winter. | H. 1/2 m D. 30 cm T. 12 weeks | Blue flowers like forget-me-not. |

HOME GARDENING

| 1 | 2 | 3 |
|---|--|---|
| <i>Antirrhinum</i> (Snapdragon) | | |
| Popular with children as 'Dog Flower' — lip when pressed sideways opens like a barking dog's mouth. Very popular for borders with striking erect flower spikes and large number of flowers open at a time. Dwarf, intermediate and tall varieties. Seedlings susceptible to 'damping off'. | H. Dwarf 15-22 cm. Intermediate 45-60 cm. Tall 1 m. D. Dwarf 10-15 cm Intermediate and tall 25-30 cm T. 14-16 weeks | Various colours, white, yellow, pink, maroon, orange, apricot, etc. Single or bicolour. Recent introductions are more often tetraploid varieties. |
| <i>Arctotis</i> | | |
| Excellent for carpet bedding. Flowers are like single large daisies. Foliage is grey-green. Sometimes referred to as 'African Daisy'. | H. 1/2 m D. 25 cm T. 12 weeks | Common colour — white with purple centre. Now available in shades of orange, bronze, yellow, crimson, mauve etc. with a contrasting centre. |
| <i>Aster</i> | | |
| Pretty in border or pot; very good cut flower. Susceptible to heavy rain and frost. Types: (i) Giants of California, (ii) Ostrich plume, (iii) Comet, (iv) Anemone-flowered. Sometimes referred to as 'Michaelmas Daisy'. | H. 25-45 cm D. 20-35 cm T. 12 weeks | Various colours, shades of white, cream, pink, grey, lilac blue, ashy blue, mauve, maroon; single and double hybrid varieties. |
| <i>Balsam</i> (<i>Impatiens</i>) | | |
| Pretty annual and perennial varieties. Breaking open of seed pods — an attraction for children. Single varieties allowed to flower without stopping or pinching off side growth. Double ones trained on single stem with no side shoots. Best garden type is the Camellia-flowered. Perennial varieties can be propagated from cuttings. They need protection from sun. | H. 1/2 m D. 22 cm T. 6-8 weeks | Shades of white, violet-purple, rose pink, red and mauve; single and double. |
| <i>Bellis</i> | | |
| Popularly known as perennial daisy or 'Michaelmas Daisy', bears double flowers. A perennial in the hills is cultivated as an annual in the plains in winter. Makes a beautiful edge. In the hills the flowers appear in succession, in summer needs protection from afternoon sun. On a hot day, the plant | H. 10-15 cm D. 22 cm T. 6-8 weeks | White and pink. |

FLOWERS, HERBACEOUS BORDER AND ANNUALS

| 1 | 2 | 3 |
|---|--|---|
| looks withered. It revives soon with light watering. Propagation by seed or root division. The former is said to give more floriferous growth. | | |
| <i>Brachycome</i> (Swan river daisy) | | |
| One of the showiest pot plant. Good for edging as well as pots. One single plant with repeated stopping and liquid feeding is trained to produce a compact mass almost spherical with no visible foliage of about 85 cm diameter. New Delhi Flower Shows attract such specimens. Grown <i>in situ</i> . | H. 15-20 cm D. 15-20 cm T. 12 weeks | Lilac, lilac-blue, white, with or without dark centres. Pale blue of original Swan river daisy looks the grandest. |
| <i>Calceolaria</i> | | |
| An extremely pretty annual attains its best in the hills. It is grown in North Indian plains. It is suitable for edging as well as for sprays. Pots of it make pretty house plants. | H. 20-30 cm D. 20-30 cm T. 3-3½ months | Bright yellow, golden yellow, apricot yellow with or without chocolate purple spots. |
| <i>Calendula</i> | | |
| Very effective border and pot plant. Popular for rich colour, mass effect, long flowering period, easy to grow. | H. 25-30 cm D. 20 cm T. 8-10 weeks | Orange — most popular colour. Others yellow, lemon and off-white. Single and double. Of recent introduction are pale colours with dark centres. |
| <i>Campanula</i> (Canterbury bells) | | |
| A very handsome plant, with bell-like flowers pendulating on both sides of the stem. Thrives in the hills in semi-shade. Varieties: annual, biennial and perennial. | H. 45-75 cm D. 45 cm | Purple-blue looks the grandest. Other colours are white, pink, shades of blue and mauve. |
| <i>Candytuft</i> (<i>Iberis</i>) | | |
| Popular for mass effect of compact cylindrical shaped flower-heads produced in profusion. Good cut-flower. Does equally well on transplantation as well as grown <i>in situ</i> . | H. 30-45 cm D. 20-25 cm T. 8-10 weeks | White, lilac and carmine. |

HOME GARDENING

| 1 | 2 | 3 |
|--|--|---|
| Carnation (see under Chapter 7) | | |
| <i>Chrysanthemum</i> (Annual) | | |
| Grown from seed. Flowers like single daisies. Easy to grow as a border for mass effect. Excellent cut-flower. | H. 60-90 cm D. 45 cm | Vivid colours, crimson, yellow, pink, white, bronze or one colour merging into another, or with distinct zone of a second colour. |
| <i>Cineraria</i> | | |
| One of the showiest annuals for mass of flowers cluster together overshadowing completely its broad leaves. Objects to direct afternoon or evening sunshine. On a hot dry day leaves show stress conditions, light spray with water helpful. <i>C. maritima</i> has very pretty grey green foliage. Does well in the hills. Yellow flowers are not so conspicuous. | H. 35-45 cm D. 30 cm T. 10-12 weeks | Bright shades of blue and magenta and bi-colour with white-blue, white-magenta. |
| <i>Clarkia</i> | | |
| Tall plant with numerous flowers in pastel shades of pink; lends dignity to the scene by its erect behaviour. Good for borders, blooms are round and fluffy. Foliage is pretty, stem is thick with flowers almost from bottom to top. It is said that <i>Clarkia</i> does not like heavy rains and moisture and direct sowing is preferable. But I found that it did extremely well in Shillong and Guwahati in winter on transplantation. | H. 90 cm-1 m D. 45 cm T. 12 weeks | Shades of pink, and also salmon to plum colours. |
| <i>Cleome</i> | | |
| Attractive for interesting shape of flowers like spiders. Useful as tall border plant. Flower petals show unusual characteristic of opening gradually. Seedlings susceptible to damping off. | H. 1-1 $\frac{1}{2}$ m D. 60 cm T. 10-12 weeks | White, mauve and rose-pink. A perennial variety with yellow flowers is also reported. |
| <i>Clanthus</i> | | |
| Known popularly as 'Parrot's beak flower' because of resemblance of the shape of flower to the parrot's beak. In the hills propagated by cuttings as a perennial. Flowers droop in clusters. An unusually pretty flower, with grey foliage, should be grown <i>in situ</i> . | H. 60-75 cm D. 50-60 cm T. 12 weeks | Bright red with a blotch of purple-black at the centre. |



19. Double *Petunia*



20. Anthurium



21. Chrysanthemum 'Spider type'

FLOWERS, HERBACEOUS BORDER AND ANNUALS

| 1 | 2 | 3 |
|---|---|--|
| Cock's comb | | |
| There are species — <i>Celosia cristata</i> with flower heads like the cock's plume and <i>C. plumosa</i> with narrow conical flower heads; <i>C. cristata</i> has tall and dwarf varieties. Dwarf varieties with compact heads massed together look attractive. | H. Dwarf 15-20 cm Tall 60-75 cm D. Dwarf 15 cm Tall 40 cm T. 10-12 weeks | <i>C. plumosa</i> has bright yellow, orange and marooned-red colours. <i>C. cristata</i> — common colour is bright maroon red, but now available are shades of cream, yellow, pink, rust, orange, maroon, red etc. |
| <i>Coleus</i> | | |
| An extremely popular foliage plant with wide range of colour combinations of dark green, pale green, copper-brown, purple, cream etc. Leaves are smooth or serrated. Pinch off the top of the plant when 15 cm (6") high and also the flowering stem. Can be grown from cuttings or seed. Also, see under 'House Plants'. | H. 45-60 cm D. 30 cm T. 12 weeks | Flowers inconspicuous. |
| <i>Coreopsis</i> or <i>Calliopsis</i> | | |
| There are perennial and annual varieties. Do well in the hills as well as the plains. Perennial varieties propagated from root division. Annuals raised from seed. Perennial varieties are really strong and can grow under most neglected conditions. They are drought resistant also. In New Delhi, cultivated on both sides of Rajpath and trodden over completely during Republic Day Parade. They revive and bloom in April-May. Good cut-flower. Can be grown all round the year in the plains. | H. Perennial: 30-45 cm Annual: 60-90 cm D. 30 cm T. 8-10 weeks | Perennial: bright golden yellow. Annual: wide range of colours with centre contrasting with the petals. Most common is yellow or orange with dark brown. |
| Cornflower | | |
| Cultivated varieties very superior to the wild ones. Good cut-flower. Dwarf and medium tall varieties. | H. 60-75 cm D. 45 cm T. 10 weeks | Blue — known as cornflower blue or Oxford blue, pink, white, purple-blue, single and double. |
| Cosmos (<i>Cosmea</i>) | | |
| Feathery, light and soft foliage, star-like flower, good for cutting. Can be transplanted or sown <i>in situ</i> . Double varieties as pretty as <i>Chrysanthemum</i> . The most attractive feature of the plant is its delicacy and soft texture. | H. 1-1½ m D. 45 cm T. 8 weeks | White, shades of pink-rose, mauve and crimson. Marigold orange of recent introduction. Double and single varieties. |

HOME GARDENING

| 1 | 2 | 3 |
|---|---|--|
| <i>Delphinium</i> | | |
| Pretty, medium tall, border plant with erect spikes of bright colour. Thrives in hills where it is a perennial plant. Can be grown from seed or root division. Very good cut-flower. In the plains, seeds do not germinate until cold weather commences. In the hills, can be grown from cuttings. | H. 45-60 cm D. 30 cm T. 14-16 weeks | Royal blue — known as <i>Delphinium</i> blue with pale yellow centre. Also in shades of blue-lilac. |
| <i>Dianthus</i> (See under Chapter 7) | | |
| <i>Dimorphotheca</i> | | |
| Very pretty for dazzling mass effect. Good for rockeries. Flowers open with sunrise and close with evening. Very effectively used at the Buddha Jayanti Park, New Delhi. Can be transplanted or grown <i>in situ</i> . | H. 30-40 cm D. 20-30 cm T. 12 weeks | Shades of orange yellow; apricot and lemon; and glistening white. |
| <i>Eschscholzia</i> (Californian poppy) | | |
| Popularly known as 'Butter Cup Flower', with feathery grey-green leaves and bright flowers, popping out right above. One of the most attractive annuals. Flowers close in the evening. New flowers appear in the morning. Reported to do better by direct sowing. My results with transplantation were very successful in Shillong and Guwahati. Plants come up by themselves from the seeds fallen from the last year. Unrivalled for its carpet effect. | H. 30-40 cm D. 20 cm T. 12-14 weeks | Bright orange, yellow and cream; petals glisten as if freshly painted. Bright, orange colour is preferred. |
| <i>Forget-me-not (Myosotis)</i> | | |
| With its dwarf plant and tiny flowers, very suitable as an edging plant and also for rock garden. | H. 15-20 cm D. 15-20 cm T. 16 weeks | Bright blue |
| <i>Foxglove (Digitalis)</i> | | |
| A showy plant with succulent leaves and tall spikes containing 40-50 bell-shaped flowers, each arranged in pendulous form. Biennial: suitable for partial shades. Seems to be partial to water courses where seeds deposit themselves naturally. Sowing seeds <i>in situ</i> is generally recommended, but I got excellent results with transplantation in Shillong and Guwahati. | H. 1¼ m D. 30 cm T. 16-18 weeks | White |

FLOWERS, HERBACEOUS BORDER AND ANNUALS

| 1 | 2 | 3 |
|---|---|--|
| <i>Gaillardia</i> | | |
| Very long blooming period of about 4 months; can be grown throughout the year in the plains, but better to confine it to the summer and rains, as prettier choice available for the winter. Very good cut-flower, also used in bouquets. Mainly propagated by root division. | H. 30-45 cm D. 48-60 cm T. 12 weeks | Single or double globular flower-heads. Most common are in combination of yellow and brown red colour. |
| <i>Gazania</i> | | |
| An irresistible low perennial plant of the hills grown as annual in the plains. Foliage is silver-coloured underneath. Flowers are daisy-like and close in the evening. Good for rockeries and pots. Flowers produced in profusion successively over a long period of 2-3 months. Propagated from cuttings easily in the hills. | H. 22 cm D. 20 cm T. 14-16 weeks | Yellow, orange, bronze, rose-pink, white and cream with dark contrasting centres. |
| <i>Gerbera</i> | | |
| One of the prettiest perennial house plant. Propagation generally from root-division; also from seed. Excellent cut-flower. Flowers rise much above the low foliage. | H. 25-30 cm D. 30 cm | Shades of pink, rose and deep-rose. Single and double. |
| <i>Godetia</i> | | |
| Clear light shades with dark centres in mass on a dwarf plant. Very pretty and distinctive. Susceptible to heavy rain, heavy casualties on transplanting. Direct sowing preferred. | H. 45-60 cm D. 30-45 cm T. 12 weeks | Pearl white, shades of pink, mauve or lavender or crimson. |
| <i>Gomphrena</i> | | |
| A popular 'everlasting' flower, easy to grow. Produces a mass of small globular flowers. | H. 45 cm D. 30 cm T. 10-12 weeks | Common colour is purple. Others include orange, pink and off-white. |
| <i>Gypsophila</i> | | |
| A light and airy plant with many shoots bearing innumerable tiny flowers. Arranges well with the aristocratic sweet peas or other flowers because of its natural ease of behaviour. | H. 60 cm D. 30 cm T. 10 weeks | Prettiest and most common is white colour. Others are pink, rose, etc. |
| <i>Helichrysum</i> | | |
| Known popularly as 'Paper flower' because of | H. 1 m | Prettiest colour is golden- |

HOME GARDENING

| 1 | 2 | 3 |
|--|-------------------------|--|
| the texture of petals. The cut-flowers have almost ever-lasting keeping quality—blossoms as fresh after 6 months as on the day they are cut. Can grow in very poor soil in the nooks of outside walls. | D. 45 cm T. 12 weeks | bronze. Others are pink, buff, brown, brown-red. |

Hollyhock (*Althaea*)

The tallest annual (excluding sweet peas which climb to greater heights), it is an excellent background plant for herbaceous border. Flowers on both sides of tall spikes, almost from bottom to the top look extremely pretty. Not good as a cut-flower. Does better if sown *in situ*. In the plains single or semi-double varieties only grow. Double varieties in the hills are biennial.

H. 2-2½ m
D. 60-90 cm
T. 16-18 weeks

Single or double in many colours of pink, rose, acacia yellow, cream, white, maroon, red. Flowers are self-colours or with contrasting centres. A number of named varieties bred in Indian agricultural research institute, tall as well as dwarf are now available.

Kochia

A very ornamental foliage plant popular as a summer cypress, globular in shape. Its light green colour is soothing in summer. Excellent for pots as well as a distinctive dwarf plant along the garden path. Does better in the plains but it was quite attractive in Shillong when its foliage took on copper-brown hue towards the beginning of winter.

H. 1 m
D. 45-60 cm

Crimson flowers inconspicuous.

Lady's lace (*Pimpinella monica*)

Easy to grow: makes an effective display with its dainty, lace-like tiny white flowers arranged in large round clusters. Popular for the back row of a herbaceous border. Good for floral arrangement and a good cut-flower.

H. 1-1½ m
D. 45-60 cm
T. 10 weeks

White flowers.

Larkspur

A popular border plant with tall spikes. Direct sowing *in situ* is reported to be preferred. My results with transplantations were very good in Shillong as well as Guwahati. Plants grow from the seed fallen in the last year. Seeds do not germinate until weather fairly cools till beginning of November in the plains.

H. 1 m
D. 30 cm
T. 12 weeks

Various: mauve, purple, pink, salmon, white, red, etc. Single and double.

FLOWERS, HERBACEOUS BORDER AND ANNUALS

| 1 | 2 | 3 |
|---|--|--|
| <i>Linaria</i> | | |
| Perennial and annual varieties. Seeds of perennial varieties sown in one year, flower in the next. Make a dainty carpet with its mass of delicate coloured spikes of tiny flowers like miniature snapdragons. | H. 30-35 cm D. 15 cm T. 10-15 weeks | Soft shades of violet, crimson, white, lemon, yellow, pink, mauve, contrasting delicately with darker shades or bright contrasts of opposite colours. |
| <i>Linum</i> | | |
| Cultivated flax plant. Attractive for its neat looking, light foliage supporting mass of bright, single flowers. Dwarf varieties suitable for rockeries. Closes as soon as sun goes off them. Plant is slender and erect. | H. Dwarf 15 cm Medium 60-90 cm D. Dwarf 8 cm Medium 20 cm T. 14-16 weeks | True flax-blue, rosy magenta and crimson common, yellow occasionally. |
| <i>Lupin</i> | | |
| A perennial, also cultivated as an annual. Spikes of flowers produced in mass, make colourful display. As a perennial throws up as many as 20-30 spikes per plant. Sow <i>in situ</i> . Can be propagated from cuttings in the hills taken after flowering. | H. 60-75 cm D. 45-60 cm T. 12 weeks | Common colour blue and light pink. Needs introduction from abroad of bright bi-colours of Russel lupins in yellow and mauve, white and blue, white and red, yellow and rust, yellow and blue, etc. |
| <i>Marigold (Tagetes)</i> | | |
| Very popular, easy to grow, excellent cut-flower, French varieties very effective as carpet and edging plants. African varieties make attractive tall plants. Stems of African varieties very fragile. Stake them right up to the flower. <i>T. signata pumila</i> makes a lovely carpet of bright yellow flowers. A beautiful example is in gardens of IIT, New Delhi. | H. French 15-20 cm Others 1-1½ m D. French 15 cm Others 60 cm T. French 8 weeks Others 12 weeks | Yellow, orange, lemon, dark brown and combination of these shades; single, double anemone type from tiny button size to double <i>Chrysanthemum</i> size. |
| <i>Mesembryanthemum</i> | | |
| Popularly known as 'Livingstone Daisy'. One of the loveliest edging plants suitable for rockeries. Produces such a mass of flowers that leaves are completely hidden. Flowers close in the afternoon as the sun goes off. Picking off dead flowers is a nuisance as flowers are produced in rapid succession. Flowers are daisy-like, leaves are grey-green, thick and fleshy. A rockery only of this flower is a gorgeous sight. Does better at higher elevations. | H. 10-15 cm D. 20 cm T. 12 weeks | Prettiest and most common is magenta with white centres. Others are golden yellow with purple, brown, scarlet-red with white, cream with scarlet or crimson. |

HOME GARDENING

| 1 | 2 | 3 |
|--|---|---|
| Mignonette | | |
| Very fragrant, soft coloured, dwarf plant. Thrives better under partial protection of projected roofs. Sow the seeds <i>in situ</i> . | H. 15-30 cm D. 20 cm T. 12-16 weeks | Buff, yellow and white. Red is also available abroad. |
| Mimulus | | |
| Known as 'Monkey flower'. Pretty carpet plant. Suitable for hanging baskets, beds and rockeries. | H. 23 cm D. 30 cm | Yellow, or orange, speckled with maroon dots at outer edges. |
| Nasturtium (<i>Tropaeolum majus</i>) | | |
| Loves poor soil, excellent for rockeries and covering wasteland. Good for hanging baskets also. Cultivated plants require constant defoliation as soil is generally richer than required. Climbing types also. 'Golden Gleam' and 'Scarlet Gleam' are most popular varieties. Grow <i>in situ</i> . Good cut-flowers. Very effectively used amidst rocks in Buddha Jayanti Park. | H. 20-30 cm D. 20 cm T. 10-12 weeks | Yellow, orange, maroon, scarlet. Single and double. Single and bi-colour. |
| Nemesia | | |
| Rich in colour; one of the prettiest annuals; good for borders and pots; long flowering period. Flowers produced in profusion, at the same time, make it a showy plant. | H. 30-40 cm D. 20 cm T. 12-14 weeks | White, yellow, orange, pink, mauve, bronze-red with single colour or contrasting centres. |
| Nicotiana (Tobacco flower) | | |
| With its sweet-scented tubular delicate colours, flowers borne on tall erect stem, the plant looks pretty. Good cut flower. Flowers close in the evening and open in the morning. | H. 60 cm D. 30 cm T. 12-14 weeks | Yellow, white, pink, crimson, rose, flush pink. |
| Pansy | | |
| Can easily be called the 'King of annuals'. Beautiful 'Show' and 'Fancy' pansies available. Different from viola. Pansy has more marked rays and prominent centre. Excellent as carpet plant, for rockeries, pots and hanging baskets. | H. 10-15 cm D. 15 cm T. 16 weeks | Various colours like butterfly wings, with marked rays, edges or centre. |

FLOWERS, HERBACEOUS BORDER AND ANNUALS

| 1 | 2 | 3 |
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| <i>Pelargonium</i> (see under Shrubs) | | |
| <i>Pentstemon</i> | | |
| Perennial, propagated from cuttings, grows in the hills only. Starts blooming in early summer and continues till autumn. Bright coloured bell-shaped flowers are borne on tall spikes. | H. 60-75 cm D. 45 cm T. 12-14 weeks | Flowers in beautiful pink, rose, mauve, crimson, contrast with white in the throat. |
| <i>Petunia</i> | | |
| Glorious border plant with vivid colours and carpet effect. Single and double varieties — Single varieties more free flowering and better for carpeting. Grown from cuttings also. Good cut-flower. A double variety I grew in Shillong continued to bloom profusely throughout the year. | H. 22-45 cm D. 30-45 cm T. 16-20 weeks | White, red, salmon, apricot, scarlet, mauve, pink, violet, purple or with contrasting colour stripes. There are attractive fringed varieties also. |
| <i>Phlox</i> | | |
| An annual, popular for its rich carpet effect, single or multi-colour. Equally at home in the hills and plains. Easy to grow. Propagation by seed; has soft fragrance. Perennial varieties produce very pretty effect with compact cylindrical heads. Propagation by root division or seed. Suitable for higher elevations. | H. 20-30 cm D. 30 cm T. 14-16 weeks | Various colours in annual — shades of white, pink, yellow, crimson, lavender, violet-lavender-blue, etc. Single colour or with contrasting colours. Varieties with fringed petals or with rays of contrasting colours looking like stars. Perennial varieties are mauve, pink, lilac and white. There is a pretty white variety with purple centre. |
| <i>Pinks (Dianthus)</i> | | |
| One of the loveliest garden plants, easy to raise, sturdy, vigorous, not prone to many diseases, creates a pretty carpet effect. Varieties — annual, biennial and perennial suitable for herbaceous border, beds, rockeries or edging. Miniature pinks known as 'Alpine Pinks' which are only 7-10 cm. Includes Indian Pinks (<i>D. chinensis</i>); Japanese Pinks (<i>D. hedderwigii</i>); <i>D. allwoodii</i> a cross between the Carnation and the Pink. There is also a cross between <i>D. allwoodii</i> and the Sweet William. | H. Dwarf 7-10 cm Medium 25-30 cm | Lovely varieties to suit different tastes — in self or bicour with smooth or fringed petals single, semi-double or double. One of the most beautiful ones is a dark maroon variety which look like black with a lemon fringe. |

| 1 | 2 | 3 |
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| Poppy | | |
| <p>Instead of traditional red poppy varieties single or double, with plain or fringed edges, striped or plain are available. There are some like <i>Ranunculus</i> or carnation. Shirley poppy is the damtiest. There are miniature poppies suitable for rockeries. Should be grown <i>in situ</i>. Poppy is prone to bacterial blight and downy mildew and occasionally to minor leaf spots. Scales and leaf hoppers are common pests.</p> | <p>H. Dwarf 15 cm Medium 60-90 cm D. Dwarf 10 cm Medium 30 cm T. 12 weeks</p> | <p>Shades of pink, rose, salmon, yellow, orange, cream.</p> |
| Portulaca | | |
| <p>Called as 10 O'clock flower, it opens when the sunshine is bright by office time and closes as the offices close by the evening. Grows well in sunny positions only. Also does not open on cloudy days. Leaves are succulent and thin pencil-like. Better results with direct sowing. Makes pretty hanging baskets or pot plant in shallow pans. Can be grown from cuttings.</p> | <p>H. 15 cm D. 10 cm T. 8-10 weeks</p> | <p>Brightest colours of yellow, scarlet, crimson, rose, pink, magenta—single and double.</p> |
| Primula | | |
| <p>One of the loveliest pot plants excellent for rockeries. There are the older varieties, innumerable, very short 8 cm (3 in.), almost forming rosette with wrinkled leaves like <i>P. veris</i> which still continue to be hot favourites, and there are taller hybrid varieties with bi-colour frilled petals, semi-double, picotee edges, bright contrasting centres. There are innumerable colour combinations of white, yellow, crimson, bronze, maroon, brown, violet, blue, rose, lavender, mauve, etc.</p> <p><i>P. chinensis</i> is a very showy variety with bigger bloom. <i>P. malacoides</i> is the common one which produces a number of erect stalks of tall mauve flowers. The foliage is light green and greyish hairy underneath.</p> | | |
| Salvia | | |
| <p>Striking for mass effect as border plant. Poor cut-flower. Can be grown from cuttings also. Does well in semi-shade also. <i>Salvia splendens</i> is the most popular crimson-red</p> | <p>H. 30-75 cm D. 30-38 cm T. 12 weeks</p> | <p>Red, purple, shell-pink, off-white, in spikes. Most popular colour – red.</p> |

FLOWERS, HERBACEOUS BORDER AND ANNUALS

| 1 | 2 | 3 |
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| <p>variety. In the hills a perennial variety, <i>S. farinacea</i> with violet blue and white flowers makes a very pretty mass of flowers in rainy season. There are dwarf varieties also. There are some other perennial varieties also, red, cream-vermilion, etc.</p> <p><i>Salpiglossis</i></p> <p>Very striking flowers with veins marked in contrasting colours. Does not like heavy rains. Grows at higher elevations.</p> <p><i>Saponaria</i></p> <p>A plant of spread-out habit bearing blooms dotted all over the plant like <i>Gypsophila</i>. Very good cut-flower like <i>Gypsophila</i>. There is a pretty variety with magenta-pink spikes. This is comparatively shorter.</p> <p><i>Schizanthus</i></p> <p>An annual known as 'Poor man's orchid' or 'Butterfly flower', its flowers are as unusual and pretty as orchids and as multicoloured as butterflies.</p> <p><i>Shasta daisy</i></p> <p>One of the loveliest jungle flowers, which grows wild on the slopes in the Himalayan hills. Its mass of white blooms presents an unforgettable sight. A perennial in the hills, grown as an annual in the plains.</p> <p><i>Statice</i></p> <p>A perennial also cultivated as an annual. Its unique flower spikes resemble <i>bajra</i> corn-heads, though narrower and brighter in colour. Cut-flowers remain fresh and retain colour for many months.</p> <p><i>Sunflower (Helianthus)</i></p> <p>Attractive as heads stand out uniformly much above foliage in one direction. The fields of sun-</p> | <p>H. 60-90 cm D. 30 cm T. 16 weeks</p> <p>H. Tall 60 cm Dwarf 45 cm D. 30-45 cm T. 14 weeks</p> <p>H. 40-50 cm D. 45 cm T. 16 weeks</p> <p>H. 30 cm D. 22 cm T. 9-10 weeks</p> <p>H. 30-45 cm D. 30 cm T. 15-16 weeks</p> <p>H. 1-1½ m D. 60 cm</p> | <p>Shades of white, yellow, brown, crimson, violet, blue, brown-black.</p> <p>Light pink, rose pink, magenta pink. Single sprays or spikes.</p> <p>Multicoloured with contrasting tints and stripes, in combinations like <i>Nemesia</i> or <i>Linaria</i>.</p> <p>White blooms in May-June in the hills. Winter flowers in the plains.</p> <p>Prettiest and most common colour is rose pink. Others include blue-mauve, yellow etc.</p> <p>Most common is bright yellow with black centre. Other</p> |

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| 1 | 2 | 3 |
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| flower cultivated for oil production look very distinctive. A good cut flower. It is drought-resistant. | T. 8-10 weeks | include dark maroon, rust, bronze, etc. Single and double varieties. Varieties with rolled petals are also available. |

Sweet pea (Separately covered in this chapter)

| | | |
|--|-------------|--|
| Sweet William — raised from seed sown in early summer which flower the next year. There are some annual strains also. Some of the annual varieties flower in the plains. The others grow in the hills only where they are perennial. | H. 30-40 cm | Flowers borne in beautiful round clusters comprising single flowers of white magenta, rose carmine, crimson, etc. in self colours or with contrasting colours. Flowers in deep crimson with white look gorgeous. |
|--|-------------|--|

Verbena

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| A very pretty perennial with large compact heads of flowers on low plants of trailing habit. Can be easily propagated from cuttings. The shoots, pegged down with small sticks or stone and covered lightly with soil, easily take roots. This method can be adopted for giving a bushy mass effect also. Because of its trailing habit, makes a pretty hanging basket and also a pot plant kept on a high position allowed to trail down the sides, can be grown from seeds also. <i>V. hybrida</i> is very attractive in self colours or in contrast. Leaves are hairy, soft to touch. <i>V. erinoides</i> with tiny lilac-blue flowers and feathery small leaves is a very popular rock plant. Its mass of soft-coloured blooms over a long period contrast beautifully with the ruggedness of the surrounding rocks. Does well in the hills and plains. There are pink and white varieties also but not so sturdy. In Delhi or roadside, attractive carpet effect has been created with it. | H. Tall 25-30 cm Dwarf 15-20 cm D. 10-15 cm | White, crimson, purple, magenta, purple-blue, etc. in single colour or contrasting with white centres. |
|---|---|--|

Viola

| | | |
|---|----------------------------|---|
| One of the prettiest bedding plant. Can be propagated from cuttings or seed. Difference | H. 10-15 cm D. 12-15 cm | Single or bicolour, self colour or rayed like pansies in shades |
|---|----------------------------|---|

FLOWERS, HERBACEOUS BORDER AND ANNUALS

| 1 | 2 | 3 |
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| between pansy and viola, see under pansy. Grown around small trees or shrubs, very effective. | T. 12-14 weeks | of yellow, blue, lilac-blue, cream, violet-blue. |
| Wall flower | | |
| Grows and flowers better in long winter. Soil should be porous containing lime. Sweet scented. | H. 30-40 cm D. 30 cm T. 16 weeks | Shades of yellow, bronze, rust and brown. |
| Zinnia | | |
| Very easy to grow, very good cut flower. Tall and dwarf varieties; very good for borders, blooms for long period. <i>Z. linearis</i> is a good edging plant. | H. Dwarf 15-30 cm Tall 1 m D. 20-30 cm T. 6-8 weeks | Various colours – white, rust dark brown, maroon, copper-red, yellow, etc. Single and double. Decoratives are as compact as dahlia, and chrysanthemum flowers. Some varieties have rolled petals. |

Note: The height, distance and time taken for flowering may vary in the same species according to the soil and water condition, variety, the altitude of the place, the cultural practices adopted and the desired effect to be achieved.

7

ROSES, CHRYSANTHEMUMS AND CARNATIONS

ROSES

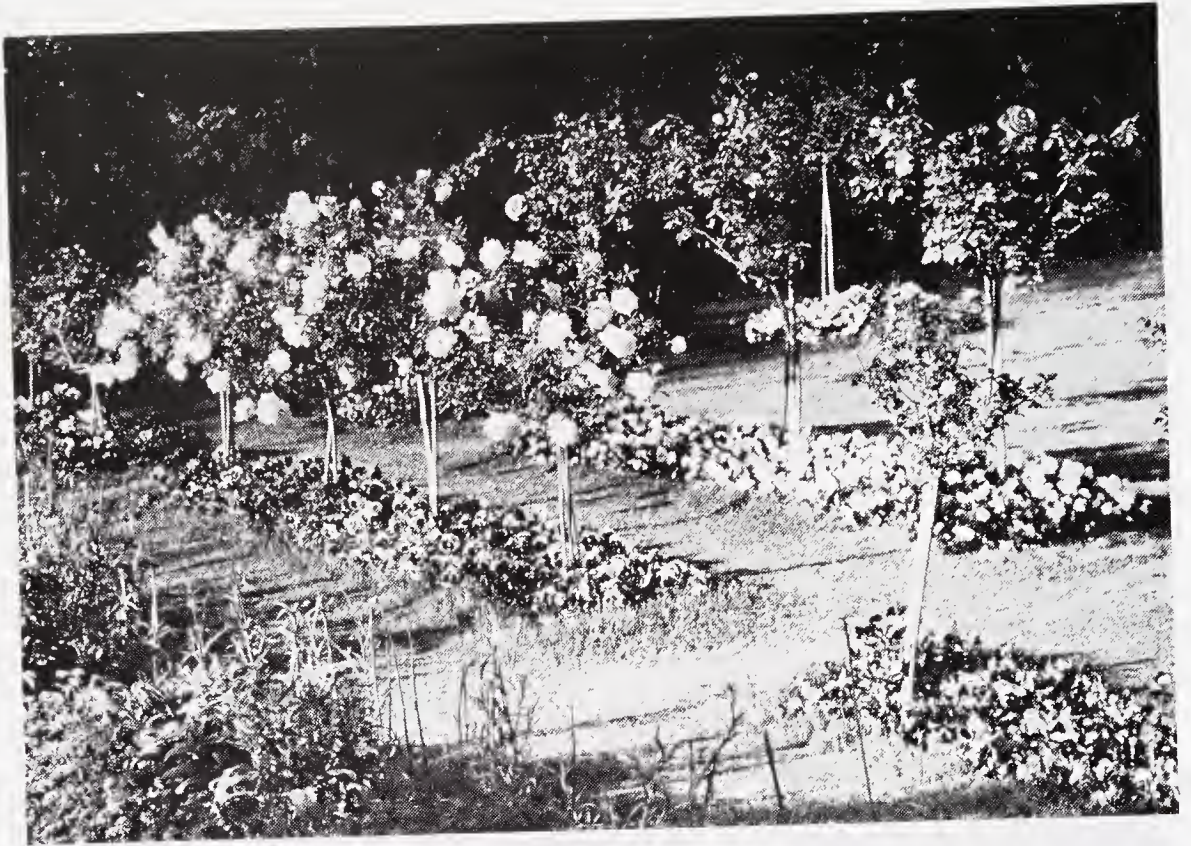
THE rose is legendary. It is woven into the history of India and enjoys pride of place. Starting from the usual pink variety, tremendous progress has been made in rose growing in the country. The roses which are seen in foreign and Indian catalogues are now available at reasonable prices in the country. The interest for fine Hybrid Tea varieties is fast growing but is still confined to a few centres only. There is a vast scope for introducing them widely. I saw very few good varieties in Shillong and the reason generally given was that the roses did not grow well there due to heavy rains and high humidity. We, however, saw a gradual successful introduction of the latest varieties there also. The keynote for success was light soil, good drainage, open sunny position, occasional sprays with insecticide during the rainy season and continuous pruning for die back. It is difficult to imagine any place in India where good rose varieties cannot grow, though the varieties doing well may differ for the hills and the plains, and for the north and the south, and for the areas with high and low rainfall.

There is a wide range of colour, size and shape in the roses. The size varies from the tiny 'Cri-Cri' to the large blooms of 'American Heritage'. The colour would vary from the soft translucent pink of 'Michele Meilland' to the brilliant vermilion of 'Super Star'. They grow as an aristocratic bush or a dignified standard. They stand out as climbers or weeping standards. Blooms are soft, lustrous and sweet. Many of them combine fragrance with vivid colours, like 'Crimson Glory' or 'Papa Meilland'. I have yet to see a prettier carpet than that of glowing pink of 'Cnattilon Rose'. Above all, roses are not fussy or difficult to grow, so long as their elementary needs are understood.

When the roses are grown as standards and half-standards, the root-stock is about



22. 'Priyadarshini' rose



23. Half Standards of 'Iceberg'

24. A 'Weeping Standard' (Banksian rose)



25. 'Dr Homi Bhabha' rose



ROSES, CHRYSANTHEMUMS AND CARNATIONS

45-60 cm ($1\frac{1}{2}$ -2 ft.) above the soil level in the half-standards, and about one metre (3-4 ft) high in the standards. I have even seen standards on the root-stock as high as 1.5 metres (5 ft). The ramblers in the hills and the 'Banksian' roses in the hills as well as in the plains can be grown as the weeping standards.

Types of roses. The popular main types of roses are Hybrid Teas (HT), Floribundas, Dwarf Polyanthas, Miniatures, Climbers and Ramblers.

Hybrid teas. The hybrid teas are large-flowered and originated from hybridization between the 'Hybrid Perpetuals' and the 'Tea' roses. They are bushy, vary in height and in other characters.

It is difficult to make a choice in HTs as so many excellent varieties in beautiful single and bi-colours and even multi-colours are available. However, given a limited choice in each colour, I would choose 'Super Star' and 'Montezuma' from the oranges, 'Blue Moon' from the blues, 'Michele Meilland' from the light pinks, 'Show Girl' from the deep pinks, 'Papa Meilland' and 'Crimson Glory' from the reds, 'Ganga' and 'Poornima' from the yellows, 'Virgo' from the whites, and 'Granada', 'American Heritage' or 'Parthenon' from the bi-colours. Some of my favourite HTs are given below colourwise.

| Colour | Name |
|-----------------------------------|---|
| Apricot, coral orange and scarlet | 'Chantre' (apricot), 'Fragrant Cloud' (coral red, very fragrant). 'Montezuma' (coral red, slight fragrance, excellent cut-flower). 'Super Star' (Vermilion) 'South Seas' (clear coral-pink). |
| Blue | 'Blue Moon'. 'Lady X' 'Sterling Silver'. |
| Light pink | 'Confidence' (Pink with glints of yellow, fragrant). 'Michele Meilland' (translucent pink, fragrant, a frequent winner of prizes). 'Royal Highness' (flush pink with a touch of cream. A prize flower). 'Eiffel Tower' (rose colour with very long stems, fragrant, frequent prize winner). |
| Deep pink | 'First Prize' 'Peter Frankenfild' |
| Red | 'Show Girl' (deep pink with marked veins, beautiful shape). 'Avon' (deep crimson, fragrant). 'Charles Mallerin' (cherry-red,, very fragrant). 'Christian Dior' (crimson). 'Crimson Glory' (crimson, most fragrant). 'Happiness' (bright crimson). 'Mr. Lincoln' (blood red). 'Okhlahoma' (blackish red). |

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| Yellow | 'Papa Meilland' (velvety blood red with marked veins, very fragrant), a top prize winner amongst fragrant roses. |
| | 'Buccancer' (canary yellow). |
| | 'Ganga' (pale burnt yellow). 'Golden Giant' (canary yellow). |
| | 'Golden Splendour', 'Grand mere Jenny' (light) yellow with pink in the edges). 'King's Ransom' (mimosa yellow). |
| | 'McGredy's Sunset' (pale yellow with touch of scarlet). |
| White | 'Poornima' (cream yellow—a recent prize winning introduction). |
| | 'Summer Sunshine' (bright yellow). |
| Bi-colour and multi-colour | 'Memoriam' (ivory white). |
| | 'Dr. Homi Bhabha', 'John F. Kennedy', 'Message', 'Virgo' |
| | 'American Heritage' (ivory white, petals with varying degree of pink at the edges, frequent winner as 'King of the Show'. |
| | 'Anvil Sparks' (coral-red petals with yellow spots and strips). |
| | 'Bajazzo' (velvety maroon-red petals above and cream underneath). 'Careless Love' (Pink with white stripes). |
| | 'Garden Party' (ivory white with touch of a pink, frequent winner as "King of the Show"). |
| | 'Granada' (varying combinations of lemon-yellow and scarlet, fragrant). 'Kiss of Fire' (carmine rose with yellow at the base, fragrant). 'Inge Horstman', 'Parthenon', 'Rose Gaujard' (white petals beautifully edged with magenta red). 'Srinivasa'. |
| | |

Floribundas. They include hybrids of HTs and Polyanthas and certain other hybrids which have the same habit of blooming in large clusters. The plants have the form of HTs and the flowering propensity of dwarf Polyanthas. There are Floribundas of HT and non-HT type.

Some of the finest examples of these are 'African Star', 'Banjaran', 'Angel Face', 'Bridal Pink', 'Charleston', 'Delhi Princess', 'Himangini', 'Iceberg', 'Prema', 'Queen Elizabeth', 'Rumba', 'Sea Pearl', 'Sonora', 'Zambra' and 'Zorina'. One of the outstanding varieties is 'Banjaran', in its colourful combination of scarlet and yellow. One of the most floriferous of these is 'Iceberg'. 'Sea Pearl' is also my favourite.

Polyanthas: As their name implies, they produce flowers in profusion either in trusses or in a mass of single or double blooms and bloom for a long period. They served as one of the excellent parents of the Floribundas. A bed of 'Chatillon Rose' of bright magenta-red with cream colour at the base made such a glorious display in early February in New Delhi that it reminded me of the fairy land stories. Another extremely pretty Polyantha rose is 'Echo', as if blushing with delicate beauty of pink and its white small semi-double blooms.

Miniatures. These are the baby roses which of late have gained in popularity due to growing admiration for miniature plants. They can be used as edges and also in rock gardens. Examples: 'Cri-Cri', 'Baby Masquerade', 'Little Sunset', 'Rosmarin', 'Starina'. There are climbing miniatures also, such as 'Climbing Pixie'.

Climbers and ramblers. A distinctive class of climbers is known as ramblers. In India, they bloom freely in the hills only. Climbers are sports of HTs, or crosses with ramblers or have been developed from rose species. As the name indicates ramblers are more free flowering and can be grown to climb in any shape of arches or pergolas, etc.

ROSES, CHRYSANTHEMUMS AND CARNATIONS

Climbers are not as flexible as ramblers. Some examples of climbers are 'Climbing Peace', 'Climbing Virgo', 'Pink Mardan', and 'Delhi Pink Pearl'.

Sometimes the Hybrid Teas throw up climbing shoots which are known as 'sports'. Their characters are identical with their parents except in respect of their climbing habit.

Essentials of rose growing. Besides the general principles of good cultivation, discussed earlier, some of the essentials of rose growing are stated below:

1. Give an open sunny place, with no overhanging branches of trees. Also avoid an exposed window-side. In hot climate in the summer, a partial shade is helpful.

2. Give good, rich, well-drained and well-dug soil, up to two spades, i.e. 50 cm (20 in.). The soil should have moisture-retention capacity.

3. The plants have to support a large number of blooms and luxuriant foliage. They need frequent good watering.

4. Soil mixture may contain 1 part of farmyard manure, 1/2 part of leaf mould, 1/4 part of wood ash, 1/4 part of sand and a handful of bonemeal. One basket of this mixture, i.e. about 10 kg may be sufficient for a vigorous HT plant in the ground. The requirement in the pots may be half of this.

5. Hybrids are generally budded on selected stocks. Therefore, suckers from the root-stock below the point of grafting should be removed. Miniature roses are an exception. They should preferably be grown on their own roots to retain their dwarf habit. Among Hybrid Tea roses 'Hadley' does extremely well in northern India on its own roots. It is vigorous, scented and richly coloured with an attractive shape.

6. In India, hybrids are budded on the root-stock 5-7 cm (2-3 in.) above the soil level. In temperate countries, they are budded 2.5 cm (1 in.) below soil level.

7. Saddle planting as explained in Chapter 3 is said to be helpful in rose planting. Exposing the roots for a week or so to direct sunshine by removal of soil before pruning, as is customary in some parts is not recommended. Instead of proving beneficial it may damage the roots and weaken the plant.

8. Except for ramblers, rose plants bloom on the new growth. Ramblers bloom on the growth of last year.

9. Roses do not like very acid soil nor do they relish too chalky a soil. Therefore, lime rose bushes only if soil is sour. This problem is generally found in the hills in India. Recommended pH for roses is between 6.0 and 7.5.

10. It is advisable to get varieties which are resistant to diseases most prevalent in the area.

11. Disbud if you want to grow blooms for exhibition. Normally disbudding is not required. Number of branches may be restricted to 3 or 4 for exhibition blooms.

12. Do not overcrowd the plants. Spacing will depend on the variety. Normally the spacing for a bush plant would be 60-90 cm (2-3 ft), for a dwarf plant 30-60 cm (1-2 ft), for a climber 2-3 m (6-9 ft), for a half-standard about 1 m (3-4 ft), for a standard 1½ - 2 m (5-6 ft).

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13. Rose is a formal plant and does not mix freely with other colours or plants. This little aristocrat does deserve the respect due to it by not interfering with its privacy by growing other plants in the same bed. If, however, it is grown in combination with other plants, there should be no flower within the bed, except as an edging of dwarf annuals like sweet alyssum, ageratum, *Tagetes signata pumila* or violas. Growing at the base of the rose standards they look attractive.

14. The climbers and ramblers can be balanced by formal and delicately pretty plants like Madonna Lily. Dwarf crocuses and *Zephyranthes* also match well with the climbers.

15. Manure a rose plant immediately after pruning. A good compost is loam (2 parts), leaf mould (1 part) and farmyard manure (1 part). In addition a tablespoonful of ammonium sulphate and handful of bonemeal may be given for a good size HT rose bush. Half of ammonium sulphate may be given along with the manure soon after pruning and the rest may be given after the first flush of flower is over by the end of December or beginning of January in New Delhi.

16. As soon as the buds form, foliar spray once a fortnight with urea 1%, i.e. 10 g (2 teaspoons) in a litre of water or with liquid manure of light tea colour is very helpful.

17. Rose, if grown in pots, would need containers 30-40 cm (12-16 in.) wide. It is helpful to re-pot them every year after removing old and dead roots. Plants may be changed after three years.

Pruning. Pruning of roses varies with the type and even within each type according to variety. Some general principles are discussed below:

Pruning is done once a year in north India in early October and twice in south India in late June and early December. In the hills it is normally done in late November or beginning of December.

Except for trimming a plant or removing weak and dead wood there may be no necessity of pruning in the first year. In the subsequent years, prune up to about half of the growth of each branch during the preceding season.

Pruning of HTs is done generally six weeks before the date of the show. Pruning may be staggered over a week to ten days to be able to get choice blooms on the day of the show.

Floribundas may be pruned as for the HTs in the first year, thereafter light pruning will do. Dwarf Polyantha and miniatures need very little pruning. The requirement of pruning of large-flowered climbers differs with the varieties. It is necessary to study their growth and flowering behaviour. Hybrid Tea climbers may seldom need pruning. In ramblers, the shoots which have flowered may be cut back. Standards will also need pruning for maintaining their shape as well as to stimulate growth. Pruning should be less than for the Hybrid Teas.

Diseases and pests. Red scales and dieback fungus are two main enemies of roses in India. Aphids also cause frequent nuisance but are easy to control. Red mites can be very troublesome. Chafer beetles and leaf hoppers are an occasional nuisance. Mildew causes



26. Chrysanthemum 'Incurving type'



27. Chrysanthemum
'Spoon type'



28. Chrysanthemum
'Pompon type'

ROSES, CHRYSANTHEMUMS AND CARNATIONS

trouble in the hills or under humid conditions. Powdery mildew and leaf spots, specially, black spots, also are troublesome.

CHRYSANTHEMUMS

The chrysanthemum is one of the most popular flowers for beds and pots, as well as for flower arrangement. Its blooms last over a period of almost 1-2 months and it continues to look attractive even when semi-dry. It is easy to grow and is not fussy about soil, light or moisture. It has a wide range of colours, shapes and sizes. There are tiny button-hole size Pompons, and there are large incurved or reflexed ones which look like decorative dahlias. Anemone-flowered chrysanthemums are attractive in contrasting colours of the heart and petals. The chrysanthemum has the advantage of multiplication from cuttings taken from choice plants.

Soil and manure. Chrysanthemums thrive in sunshine. In the plains, however, it needs a semi-shaded corner in the summer and protection from the rains. In the plains, the highest number of casualties take place during the rains due to moist heat. In the hills they should be preferably grown in rows north to south.

It needs fairly rich soil with deep digging of about 60 cm (2 ft). Good drainage and good compost is necessary. Sharp sand may be added to improve heavy soil. Lime may be added at the rate of 250 g/m² (8 oz/yd²), if required. The soil mixture, which has been tried and found successful, is loam (2 parts), farmyard manure (2 parts), leaf mould (1 part), sharp sand (1/2 part). To this is recommended to be added a handful of slow-acting mixed fertilizer like 'Rallimeal' or 'Sterameal'. Liquid manure may be given as soon as the buds appear.

Spacing and stakes. The distance between smaller varieties may be 30-45 cm (12-18 in.), while in the large varieties it may be 45-90 cm (1 $\frac{1}{2}$ - 3 ft). A good stake may be fixed at the time of initial planting. Stems carrying blooms are fragile and likely to break due to heavy rains or wind. Therefore, the initial stake may be supplemented later by additional supports for each flowering shoot. Pompon varieties, however, do not need any stakes.

Stopping. When plants are well established to a height of 15-20 cm (6-8 in.) with 3-4 pairs of leaves, first stopping may be done. In the hills, this may be in the month of May-June. A second stopping may be necessary if plants make a straggly and lean growth. Sometimes a plant produces a premature flower bud on a straight stem called a 'break bud'. It is surrounded by a number of side shoots which are called 'breaks'. The bud should be immediately pinched off taking care that side shoots or breaks just below the bud are not damaged. If stopping is done when the plant is 15-20 cm (6-8 in.) high, the formation of break bud is prevented. The side shoots may be allowed to grow until they develop buds. The number of such side shoots may ordinarily be restricted to 8 or so. In case of large exhibition blooms, the number may even be restricted to one only or at the most to three shoots. All the other shoots and the axil-growth on the selected shoots

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should be rubbed off as soon as they appear.

Disbudding. At the tip of each break, a bud called 'crown bud' surrounded by a number of small buds appears. The crown bud only may be retained and all others may be rubbed off. Disbudding is not necessary in bushy types of chrysanthemums which may be given a bushy form by regular pinching at initial stages and then letting it grow naturally. Any sucker produced by the plant before flowering should be removed.

Propagation. The usual methods of propagation of perennial chrysanthemum are from cuttings and root suckers. The method commonly adopted is propagation from suckers. But, it is reported that plants propagated from cuttings give the best results. As soon as flowering is finished, cut the stems to about 10-15 cm (4-6 in.) from the base. The stools will show growth from December. They may be left in the pots or may be lifted carefully and wintered in a raised bed. In February-March, the suckers may be transferred to 10 cm (4 in.) pots and kept pot-bound till the rains are over. Any growth on the top may be nipped off. In the plains the chrysanthemum is susceptible to decay during hot and moist weather in the rains. Plants should be kept in the shade. In late August or beginning of September they may be transferred to their regular pots of 20-25 cm (8-10 in.).

The cultivation practices mentioned above are for the perennials. There are chrysanthemum species which can be grown as annuals from seed.

Scope for improvement. Chrysanthemum offers a tremendous scope for improvement with its promising market potential. It needs to be developed with a large number of varieties as early, semi-early and late. Such range is not yet available in India.

Varieties. A number of named varieties are now available. Some of them I am familiar with have been released by the National Botanical Research Institute, Lucknow, and some by the Punjab Agricultural University.

Pests and diseases. The common pest of chrysanthemums is aphids. Beetles and bugs are also frequent. Eelworm also causes damage where it exists. Powdery mildew and wilt are common diseases. Rust is a problem in the hills.

CARNATIONS

Carnations are extremely popular and make lovely garden plants. They belong to the large genus *Dianthus* which includes Pinks and Sweet Williams also. The requirements of this family are open position, plenty of sunshine, good drainage, lime, bonemeal, sharp sand and potash. They hate acidity in the soil. In the hills they are perennials and the rest period is from November to February. Some varieties grow in the plains and they are cultivated as winter annuals.

Propagation. Propagation of *Dianthus* group can be by ground layering, cuttings, root division or seed. For carnations, ground layering and cuttings are preferred. For pinks, root division and seed are preferred and Sweet Williams are generally raised by root division.

ROSES, CHRYSANTHEMUMS AND CARNATIONS

A 'heel' cutting can be handled more easily than the other one. A cutting may be taken in July-August in the hills and in February-March in the plains. Pot the cuttings in the mixture of sand (1 part), leaf mould (1 part) and loam (1/2 part). In the plains, they are more frequently raised from the seed.

There are perpetual-flowering carnations which can be kept in flower throughout the year in the hills by proper culture and disbudding. There are also border carnations which, as the name indicates, are popular in borders or beds, i.e. they are hardy and can be grown outdoors. Again there are 'Picotee' carnations in which the edges of the petals have slightly deeper shades of matching or contrasting colours—yellow with red or white with pink. Then there are 'Bizarre' and 'Flakes' with stripes of one or more colours. There are Selfs with only one colour and no stripes or spots. There are some with very fine clove-like fragrance.

Stopping and disbudding. First stopping of carnations should be done when plants are 15 cm (6 in.) tall. Subsequent stopping may be done when the shoot has developed 2-3 pairs of leaves, thus leaving 6 good joints on the branch. No stopping thereafter may be necessary.

At the tip of each stem, a cluster of buds is formed. For exhibition purposes one bud only should be retained. The plant also puts out side buds, a little below the main flower bud. Only one may be retained here and the others may be pinched off. As soon as buds form, liquid farmyard manure may be given.

Manuring. Carnations are light feeders and a mixture of 2 parts loam, 1 part leaf mould, and 1 part farmyard manure is a good mixture. To this may be added 1/4 part sand to improve drainage, as carnations like very good drainage.

Repotting. In the hills, carnations may be repotted in the next year without cutting right back. Cutting it right back gives it a shock and does not give such good blooms as only repotting. It can remain in good flowering condition for as long as three years. In the plains, the plants need to be propagated annually.

Pests and diseases. Carnations are subject to many pests and diseases. The main pests are red spider, aphids, and thrips. Nematodes and mites may also cause trouble sometimes. Wilt is the most common disease. In the hills, rust is also a problem.

Split calyx. Another trouble with carnations is a split calyx. This is due to wrong cultural practice or defective environment, such as excessive heat or moisture, or defect in the variety. Use of a rubber band around the calyx for exhibition blooms can only check temporarily this development and the split calyx is not so noticeable, at least, till the judging time.

8

BULBOUS PLANTS

A bulb, in common usage, may mean a tuber, rhizome, corm or a true bulb. Bulbs are either fleshy stems or buds along or under the soil surface. They are an initial source of water and nourishment for the plant.

A tuber is an underground stem and is fully buried in the ground. A rhizome is also a stem but it creeps along the ground surface. A corm is a solid underground bud. A true bulb is also an underground bud but has leaf scales instead of a solid body as in a corm. Some of the examples are dahlia, potato and tuberous begonia of a tuber; canna and ginger of a rhizome; gladiolus and *Acidanthera* of a corm, and onion, lilies and *Hippeastrum* (popularly known as *Amaryllis*) of a bulb. An iris can be a rhizome, bulb or a corm. In general the word bulb has been used here to include others also.

Propagation. Most of the bulbs do not die every year but continue to produce one or more bulbs at the side of the old one, e.g. *Alstroemeria*, *Clivia*, *Crinum*, *Crocus*, *Cyclamen*, daffodil, *Kniphofia*, *Haemanthus*, *Hippeastrum* (*Amaryllis*), *Iris*, narcissus, tuberose, *Watsonia* and *Zephyranthes* while some others shrivel up completely at the end of its growing season and a new one is formed in its place like tulip, gladiolus, dahlia and ranunculus.

The usual method of propagation of bulbs is by means of offsets or substitute bulbs. Small bulbs or cormlets also grow sometimes from the side of the bulb or at the base. They grow to full size in about two years or so. Propagation is sometimes done by bulbils as in tiger lily and also from seeds as in *Lilium regale*. Multiplication can also be done by dividing the tubers as in dahlia, by dividing the rhizomes as in *Iris* or by dividing a bulb as in the *Amaryllis*.

The bulbs which do not die every year are better left in the ground, until they need dividing due to overcrowding. In the others there are two categories. Those which are not hardy like gladioli, tulips, dahlias, tuberous begonia and ranunculus, need to be lifted every year. Those, which are hardy like *Tigridia*, *Montbretia*, *Alstroemeria* and *Achimenes* can be left in the ground.

Planting. The bulbs may be planted around the trees, on grassy banks, semi-wild portions, or along the drive to the house. While planting small bulbs in the grass, they must look natural and not in formal straight lines. One of the methods recommended is to take stones of the size of the bulb and throw them at random at the place where the bulbs are to be planted. At the places the stones fall, the bulbs, may be planted. For planting in the grass, the latter may be cut to create a circular bed and the bulb may be planted at its appropriate depth. It may be covered with soil and the turf may be replaced making sure that it is not turned inside out.

The depth of planting, i.e. the soil above a bulb, varies according to its type, but, in any case, should not be more than twice the height of the bulb. If planted too deep, it may rot or may not flower. The bulbs planted at the same time, but slightly deeper, may flower later. Bulbs of the same variety which are not to be lifted each year, may be planted deeper than those which are lifted every year. A good depth for the bulbs in the hills is 5 cm (2 in.) for *Crocus*, 10 cm (4 in.) for gladiolus, 15 cm (6 in.) for dahlia, 10 cm (4 in.) for tulip, 10-15 cm (4-6 in.) for *Narcissus* and daffodil. In planting a rhizomatous plant like *Iris*, care should be taken that the rhizomes are above the ground, while the fibrous roots are inside the soil. In the plains, the recommended depth is 2.5 cm (1 in.) for *Crocus*, 6-8 cm ($2\frac{1}{2}$ in.) for gladiolus, 10 cm (4 in.) for dahlia, 3-4 cm ($1\frac{1}{2}$ in.) for *Zephyranthes*, 4-5 cm (2 in.) for *Narcissus*. The bulbs with a neck as in *Hippeastrum*, tuberose and *Pancratium* are so planted that the top of the neck of the bulb is at the soil level in Shillong with cold and humid climate, *Hippeastrum* was so planted that the whole of the bulb just rested above the soil level, but the weather conditions being dry and hot in the plains, it will be risky to expose the bulb in these areas. I found *Hippeastrum* to be very particular in Shillong, about the depth of its planting and if it was planted too deep, the bulbs refused to flower. A handful of silver sand at the base of the bulb at the time of planting helps in preventing its rot.

Soil and cultivation. A good soil mixture is loam one part, leaf mould one part, farmyard manure half part, bonemeal about 60 g (4 tablespoons) per m² (2 oz/yd²). Lime and sand may be added if necessary. Lilies in general (except 'Madonna' lily) do not like lime; dahlias however like lime. The bulbous plants generally speaking like slightly acidic soil.

Any manure or leaf mould which is not well-decayed is strictly forbidden for the bulbs as it is one of the chief causes of rotting. Overwatering in bulbs before their buds are formed is another major cause of rotting. Soil around the bulb must be kept moist, from planting till the end. Complete drying out at any time may prove to be disastrous. It is advisable to allow a bulb to form a well developed eye before planting. No 'stopping' is generally required in bulbous plants; dahlia is an exception to this general rule. Bulbs, generally, like open sunny position. Lilies, other than 'Madonna' lily, some lily-like plants and some of the smaller bulbs which grow in their natural habitat in the rock crevices, are exceptions to this. *Alstroemeria* hates direct sunshine.

After flowering, cut the flower stem but not the foliage. Leaves manufacture plant

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food which feeds the bulbs. As soon as the leaves turn yellow, cut foliage to about 10-15 cm (4-6 in.) above ground. Let the bulb remain in the ground for another week. Do not rub off the stem. It will fall off naturally.

In case of gladioli, a corm sometimes sends up more than one shoot. It is advised by some that the extra shoots should be removed to divert nutrients to the single shoot. My experience, however, is that the nutrient-requirement of a bulbous plant is very limited and even if all the shoots are retained, the size of the flowers or of the spike is not reduced.

My friends have sometimes enquired whether the bulbs change colour with passage of time due to cross pollination, etc. The bulbs produce flowers true to type and no such change takes place. Generally, this impression is caused because of wrong labelling or some mischief.

Bulbous flowering plants for the plains. Only a few of the bulbs which flower in the hills do well in the plains. In the plains, the temperate bulbous plants are grown mainly in winter and most of them need to be lifted every year. Storage of these bulbs also creates a problem. The bulbous plants which do well in the plains are as follows:

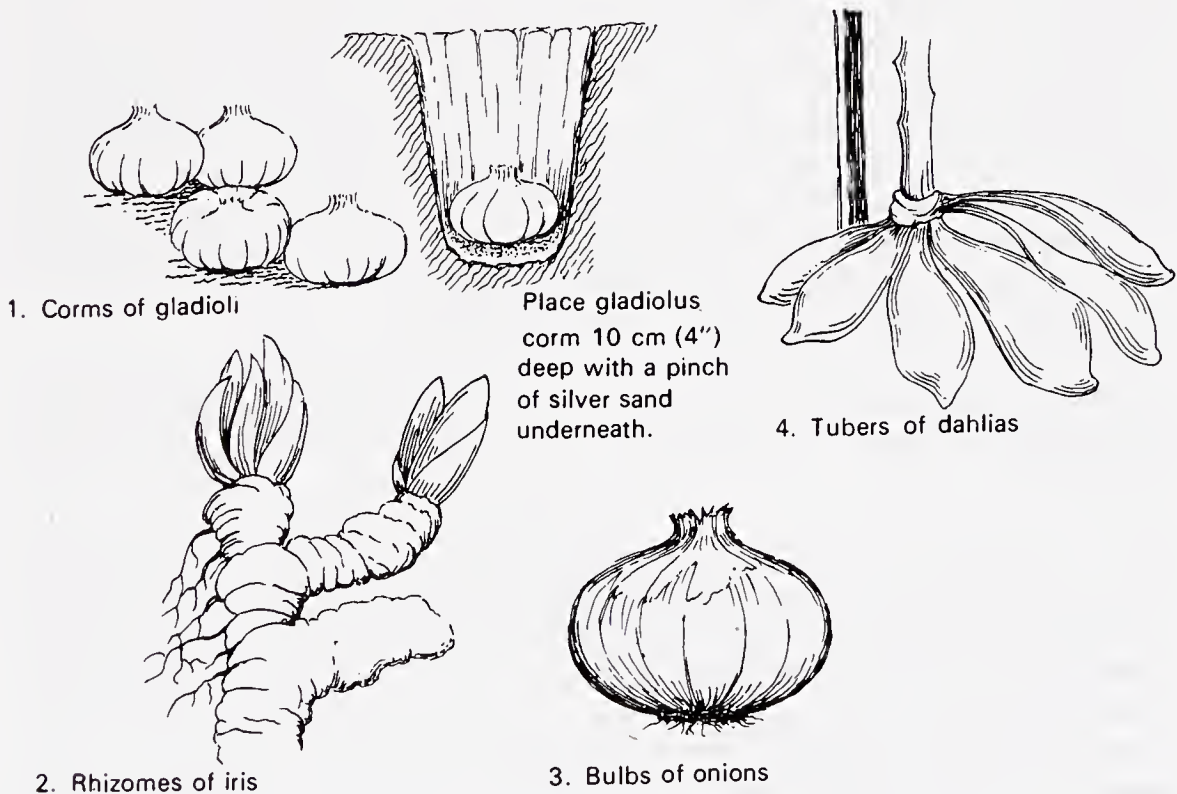


Fig. 14. (1) Corms of gladioli, (2) Rhizomes of iris, (3) Bulb of onion, and (4) Tubers of dahlias

BULBOUS PLANTS

SUMMER AND RAINS FLOWERING. *Achimenes*, *Cooperia*, *Cooperanthes*, *Crinum*, *Gloriosa superba*, *Haemanthus*, *Hemerocallis*, *Hedychium*, *Hippeastrum*, *Hymenocallis*, *Pancratium*, tuberose and *Zephyranthes*.

WINTER FLOWERING. *Acidanthera*, *Belamcanda*, *Dahlia*, *Eucharis*, *Freesia*, *Gladiolus*, *Iris* (a few varieties), *Mirabilis*, *Montbretia*, *Narcissus*, *Ornithogalum*, *Oxalis*, *Sternbergia*, *Anemone*, hyacinth and *Ranunculus* have also been successfully grown in New Delhi in the winter.

Canna and *Anthurium* flower almost throughout the year.

Bulbous flowering plants for the hills. In the hills, bulbous plants can be grown throughout the year. Some of the selected plants are as follow:

SPRING FLOWERING. *Anemone*, *Clivia*, *Cooperanthes*, *Crocus*, *Cyclamen*, daffodil, *Freesia*, *Hippeastrum* (*Amaryllis*), hyacinth, *Narcissus*, *Ornithogalum*, *Ranunculus*, *Saxifraga*, tulip, *Watsonia*, *Zephyranthes*.

SUMMER FLOWERING. *Achimenes*, *Acidanthera*, *Agapanthus* (African lily), *Alstroemeria*, *Begonia*, *Belamcanda chinensis* (Leopard flower or Blackberry lily), *Canna*, *Crinum*, dahlia, *Gladiolus*, *Gloriosa superba* (Glory lily), *Haemanthus* (football lily), *Hedychium*, *Hemerocallis*, Hosta lily, *Hymenocallis*, *Iris*, *Ixia*, *Mirabilis*, *Montbretia*, *Oxalis*, *Pancratium*, peony, *Polianthes tuberosa* (tuberose), *Richardia* (arum), *Sprekelia*, *Sternbergia*, *Tigridia pavonia*.

The spring flowering bulbs are planted in October-November and bloom from February to April-May. They can, however, be forced to bloom early by special heating facilities as a hot house. The summer flowering bulbs are planted in February-March and sometimes in April to bloom from May to September-October. *Kaempferia rotunda* belonging to ginger family sprouts from the soil, like a crocus, with the onset of rains in Shillong in April. It has very attractive white violet-tipped flowers.

Bulbous foliage plants. The popular bulbous foliage plants are as follows: *Alocasia*, *Anthurium*, *Caladium*, *Calathea*, *Colocasia*, *Maranta*, *Monstera*, *Raphidophora*.

These foliage plants have species and varieties in varying shape of green, yellow-green, white-green and gray-green leaves in self colours, bicolours, variegated with blackish green, red, yellow or white colours, deeply veined, mottled, marginated or striped, serrated, oblong, conical or round. They are excellent house plants. They delight in plenty of moisture and semi-shade. The soil mixture suitable for the ferns suit them also.

Alocasia, *Colocasia* and *Caladium* resemble each other with their heart-shaped leaves. The amateurs get confused between *Calathea* and *Maranta*. I find what we normally call *Maranta* in green leaves with rose veins is *Calathea ornata* (*roseolineata*).

Anthurium offers an astonishing range of variety in form, size and colour of foliage and flower. The brightest *Anthurium* is *A. andraeanum rubrum* with satiny crimson petals and white spathe. Some of the anthuriums may be confused with alocasias. A special mention may be made of a very pretty *Caladium* with greenish white leaves with crimson veins. *Monstera* is an extremely handsome rhizomatous climbing plant so also

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Raphidophora (see under 'Climbers').

Gladioli enjoys a pride of place in the garden or floral arrangements. Dahlias have special features. The lilies deserve a special mention. Begonias for their varieties, colour, form and foliage are unrivalled. These have, therefore, been discussed in detail.

GLADIOLUS

Its tall, elegant and colourful spikes makes it most irresistible.

It is widely grown throughout the world for bedding and cut-flower. Height about 75-90 cm ($2\frac{1}{2}$ —3 ft). A large number of large-flowered varieties have been evolved by hybridization. In addition, there are so called 'Primulinus' varieties in which flowers are wider spaced and are not so open. Some hybrids of the large-flowered and 'Primulinus' varieties are also available. Most of them, however, are imported in India. The flowers are in various attractive shades of white, cream, pink, yellow, scarlet, crimson, maroon, lilac, apricot, orange, rose, violet, etc. They are in self-colours, bi-colours or mixed shading of colours. Plant the corm 10 cm (deep) in the hills and 5 cm (2 in.) in the plains as mentioned earlier.

Cultivation. Flowers appear in spikes in 90-120 days. A specimen spike may have 16-22 flowers. The flowers remain fresh longer if the spike is cut as soon as the first flower opens. After flowering, the flowering shoot is cut off but the leaves should not be damaged as these provide nutrition for the new corm. Just before the leaves turn yellow they are cut about 10 cm (4 in.) above the ground. The plant is allowed to remain in the ground for a week or so. The corms are thereafter lifted and dried in a shady place before storing. The dried roots attached to the corm should not be rubbed off with hand but should be allowed to fall off naturally. The old dried corm which is replaced by the new one may be gently rubbed off.

Propagation and storage. A number of small cormlets form beside the main corm. They can be grown separately and produce flowers in 2-3 years. Propagation by the amateurs is generally by corms and cormlets. Multiplication from seed is a tedious process as seed germination is difficult. In the plains like Delhi, the practice recommended for best flowering next year is to lift the gladioli corms and store in a domestic refrigerator or in cold storage. The best way of storing gladioli in the hills is to keep them in dry sand in a dark cool place. Wrapping them in newspaper and keeping in a dry shady place was also found sufficient. In a hot dry place mere wrapping with paper is not sufficient as the corms shrivel up.

Some outstanding popular varieties of gladioli are as follows :

Crimson — 'Emelia', 'Majolia', 'Oscar', 'Jo Waggoner'.

Red — 'Atlantic', 'Albert Schewitzer', 'Hawaii', 'Life Flame', 'Nazrana'.

Scarlet — 'Ahoy', 'Elen', 'Sansouci'.

Orange — 'Orange', 'Oscar', 'Tunia Elite', 'Pink'.

Salmon — 'Bon Voyage', 'Sunny Boy', 'Bloom Fountain'.



29. *Lilium longiflorum*



30. *Oxalis*, a persistent weed in the hills, has many attractive species also



31. *Ranunculus*, there are many wild and cultivated species

Rose — 'Friendship', 'Lovely Melody', 'Spring Song', 'Spick and Span'.

Pink — 'Delice'.

Blue — 'Blue Bird', 'Blue Conqueror', 'Blue Ganga', 'Dutch Beauty'.

Purple — 'Blue Boy', 'King of Blacks', 'Tilae Wonder', 'Manju'.

Yellow — 'Garden Wattle', 'Happy End', 'Yellow Emperor', 'Pollygoon', 'Sapna', 'Poonam Yellow'.

White — 'Eiffel Tower', 'Mary Housely', 'Morning Kiss', 'Maria Gorretti', 'Beverly', 'Meera'.

DAHLIA

The dahlia is a very spectacular tuberous plant of Mexican origin. It has a very wide range of colours, shapes and sizes varying from the Pompons 2.5 cm (1 in.) in diameter to the large decorative ones more than 30 cm (12 in.).

Popular forms. Some of the forms of dahlias popular in India are decorative, cactus and Pompon. There are others like semi-cactus between the cactus and the decorative, or singles whose name is self-explanatory. There are 'Peony' and 'Collarette' types which are, however, not widely cultivated in the country. The decorative ones have petals pressed close together and almost covering one another. The petals in single ones barely touch each other. The cactus types display spiky florets close together and also overlapping each other. The Pompons find favour because of their compact miniature size. Dahlias are suitable for pots as well as beds. It is a very popular exhibit in the flower shows throughout the world as a cut-flower as well as a pot plant. The usual size of the pots is 30 cm (12 in.) diameter.

Dahlias have bold colours and lush foliage and therefore need bold treatment. They are at their best when massed together — in single colours or boldly contrasted. An attractive colour scheme was made with crimson dahlias and bright yellow *Celosia plumosa* in Shillong in the summer. They flower in summer in the hills and in winter in the plains.

Propagation. Dahlia can be propagated from seed, cuttings or division of tubers. Good seed taken from reliable sources gives fairly uniform crop except for colour, and is cheap also. Propagation from cuttings or tubers is easy and gives true-to-type plants. Dahlias take about 80-90 days to flower from planting of rooted cuttings, tubers or seedlings in the plains, and 90-100 days in the hills. The usual method of cultivation is from the sprouted tubers in the hills and from the rooted cuttings in the plains.

Soil and manure. Dahlias love sunshine and need to be protected from frost and cold winds. They are not fussy about soil but it should be well drained. They have to support abundant foliage and therefore need well-dug and well-enriched soil; the soil should be dug up to 45-60 cm (1½ -2 ft). Add cowdung manure and leaf mould @ 5 kg (11 lb) each and about 50 g (2 oz) of bonemeal and 25 g (1 oz) of potash for each large plant as of large decoratives. For Pompons, the requirement may be half of this. For pot

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plants a good compost would be equal parts of cowdung manure, leaf mould and soil with a tablespoon of potash and four tablespoons of bonemeal for each plant. Foliar application of urea 1 per cent at the early vegetative stage develops bright green foliage. This may be confined to the period of 30-60 days from the planting of rooted cuttings. Soil application of nitrogenous fertilizer, however, during this period tends to promote excessive vegetative growth which may cause early wilting of flowers. It should be avoided.

Division and replacement of tubers. The cluster of dahlia tubers is attached to the portion of a stem known as the collar. The collar contains the eyes of the tubers. It is better to allow the eyes to appear before undertaking division operation. The cluster is divided into portions containing one or more tubers with a part of the collar containing at least one eye. Each of these portions develops into a mature plant. The number of tubers to remain attached to the collar after the division will depend on the type of flower. For large decorative types, the number of tubers may be one or two to the collar. Cactus and medium decoratives may have three or four tubers. The Pompon types may have 4 to 6 tubers.

The new tubers replace the old tubers at the end of the season. But all flowers do best on new roots and so do dahlias. I found it a wise policy in the hills to replace the older tubers by new ones every three years.

The shape of the tubers varies with the type. Pompons and small decoratives have rounder tubers than the large-flowered ones. The large decoratives have long tubers.

Cuttings in the hills. The best time for taking cuttings is February-March. Cover the tubers with well-sifted soil and a little compost, leaving the collars exposed. Keep the material moist and protect from frost. Select 6-8 cm ($2\frac{1}{2}$ - $3\frac{1}{2}$ in.) long sturdy cuttings. Remove the bottom pair of leaves, insert in prepared ground containing one part loam, one part sand, one part leaf mould. Do not forget to label. As soon as the cutting starts making top growth, shift it to the ground where it will finally grow. Cuttings may also be taken successfully during any time of the growth of the plant, except the last few weeks. The extra basal shoots of the plant also make good cuttings. They may be cut just below the ground at the point of their growth from the collar. The flowers formed on the cuttings before they are well established should be pinched off. The cuttings taken in the early part of the season make a mature plant in the same year, but the later cuttings, give their best blooms only in the next year. Sprouted tubers are planted in April-May.

Cuttings in the plains. The cuttings are found to root well from the first week of October till the middle of November. The selected cuttings should be 6-8 cm ($2\frac{1}{2}$ - 3 in.) long with one or two pairs of leaves. Rooting hormones, Seradix B-1, is recommended for stimulating better rooting. The cuttings give rise to a large number of healthy roots in 12-15 days.

To ensure a longer period of bloom, it is better to plant the tubers of cuttings at an interval of 15 days in 3-4 lots, in the hills. In the plains, however, the winter being short, they may be tried in not more than two lots.

Spacing. Allow plenty of room to the plants. Dwarf bush types may be at a distance of 45-60 cm ($1\frac{1}{2}$ -2 ft) and bigger decorative ones at one metre (3- $3\frac{1}{2}$ ft.). Strong stakes should be fixed at the time of planting the tubers and additional supports may be added with their growth. Firm planting is essential. In the plains, the dahlias, particularly the large decoratives, do not assume the size as in the hills and the spacing may, therefore, be only 60 cm (2 ft) for the bigger varieties.

Stopping and disbudding. For large decorative dahlias, when the plant is about 40 cm (15-18 in.) high and shows 6 pairs of leaves, the stem may be cut back by 1 cm ($1/2$ in.) or so to about the fourth pair of leaves. New growth will appear from the leaf axils which will grow into flowering shoots. These may be further restricted to not more than six such shoots, which after disbudding are allowed to bear a single bloom each. This practice, however, can be adopted only in the hills, where there is a long growing period. In the plains, the large decorative dahlias grow up to 45-60 cm ($1\frac{1}{2}$ -2 ft.) only. They are not stopped and for exhibition purposes are allowed to bear a single flower on the main shoot. The plants which are stopped take about 2 weeks more to flower. It takes about 3 weeks from the tiny bud to a mature flower.

There are a number of outstanding popular varieties available in the country, some of them have been bred in India. Excellent work in breeding of dahlias is going on in the country.

Some of the outstanding popular varieties of dahlia are:

Large Decoratives

- 'Barbara Marshall'—Orange scarlet.
- 'Bhikus Mother'—Bicolour, orange to tan with white tips.
- 'Bhikus Vivek'—Vermilion.
- 'Black out (sport)'—Rosy red with dark blackish spots over petals.
- 'Black Out Sport'—Bicolour, orange to tan with white tips.
- 'Challenger'—Pale lilac striped with crimson, distinct bicolours.
- 'Cherokey Beauty'—Bright pink.
- 'Cover Girl'—Bicolour, mauve with white tips.
- 'Croydon Ace'—Deep yellow.
- 'Croydon Apricot'—Apricot to bronze.
- 'Croydon Dawn'—Apricot and cream blend.
- 'Croydon Delicate'—Mauve to pink with an attractive glistening shine.
- 'Croydon Masterpiece'—Coppery orange.
- 'Croydon Monarch'—Dark red but with a brownish-blue line.
- 'Croydon Sensation'—Bright yellow.
- 'Croydon Snowtop'—Pure white.
- 'Kelvin'—Tyrian pink.
- 'Kelvin Rose'—Rich rosy mauve.
- 'Kenya'—Nasturtium orange colour blend.

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- 'Nearest Blue'—Giant decorative, tinted blue.
- 'Nobbys light'—Yellow
- 'Prime Minister'—Rose purple colour, dark blend of pink with lavender.
- 'Sandhya'—Bright vermillion.
- 'September Queen'—Brilliant orange scarlet, reverse yellow.
- 'Swami Brahmananda'—Variegated, blackish red with pink streaks and stripes.
- 'Tenzing Norkey'—Deep blackish red.
- 'Tutu'—Bicolour, deep red with white tips.
- 'Xantine'—Yellow.

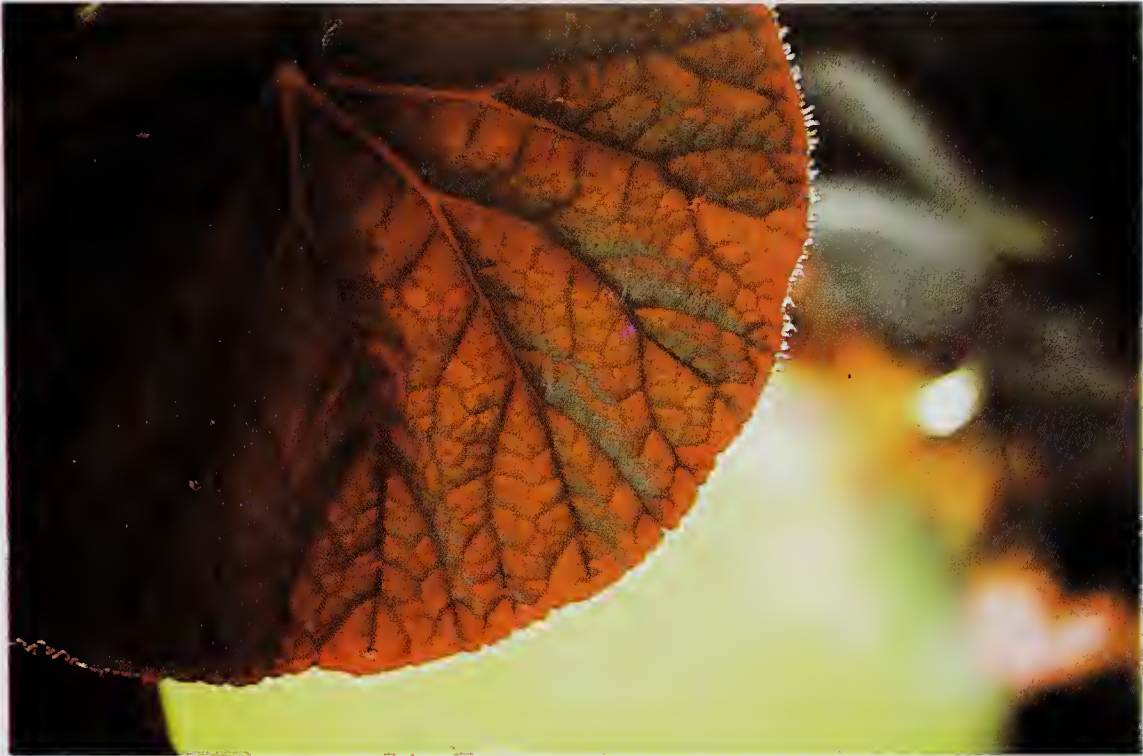
Pompons

- 'Albino'—Pure white.
- 'Dustone Stone'—Brilliant red.
- 'Glow'—Orange red.
- 'Gold Drop'—Delicately tipped flame.
- 'Iris'—Purple.
- 'Kitty'—Chrome yellow with a touch of purple.
- 'Noreen'—Pink and white blend.
- 'Potgaiter'—Canary yellow.
- 'Small World'—White.
- 'Tam Tam'—Nearly black crimson, perfect bloom.
- 'Willow Night'—Almost black.
- 'Willow Violet'—Violet.

Cactus dahlia

- 'Ami Pardien'—Terracota red with golden centre.
- 'Border Princess'—Orange and yellow.
- 'Cabaret'—Bicolour, carmine and white.
- 'Capistrano'—Bright yellow, large size, narrow petals.
- 'Dr B.P. Pal'—Bicolour, orange with yellow centre.
- 'Jyotsana'—Bicolour, purple-red with small white tips.
- 'Lace Maker'—White.
- 'Nita'—Cyclamen purple with variegation of pink.
- 'Polar Sight'—White.
- 'Silver Wedding'—White suffused delicate pink, very fine formation.
- 'Sunset'—Yellow and red bicolour.
- 'Tanjoh'—White and red.
- 'Terry'—Lavender pink.

Dahlias produce very large number of buds. In Pompon dahlias, which are grown for mass effect, no disbudding may be done. In others, the strongest bud, generally the main central one, only may be retained on each flowering shoot and the others may be removed. Disbudding should be done as soon as the extra buds appear.



32. *Begonia rex* — a delightful foliage plant

33. *Begonia semperflorens* — a heart-warming picture of joy and abundance





34. *Begonia tuberosa*



35. Crocuses burst forth in spring and autumn



36. *Cyclamen*



37. *Anemone*

BULBOUS PLANTS

Watering and feeding. Dahlias take about 80-90 days to flower from planting of rooted cuttings or tubers in the plains and 90-100 days in the hills. Dahlias need plenty of water to support the abundant foliage. On a hot day, the foliage may droop. A light spraying with plain water revives them. Dahlias are benefited by liquid manure when buds are forming. Mulching is beneficial during summer in the hills.

Pests and diseases. Dahlias are very susceptible to wilt and powdery mildew. Aphids, stalk borers, leaf hoppers and white flies are common pests. Slugs, snails and ants are partial to the dahlia tubers and sometimes reappear when flower buds are forming. A pinchful of turmeric powder at the base of the tuber, along with a handful of sand, is quite effective against the ants.

LILIES

Lilies are like aristocrats in a garden. With their magnificent erect blooms, they look attractive in a formal setting. Where they are grown by themselves, the only concession we may allow is a combination with equally striking plants like crocus. Lilies combine exquisite beauty with fragrance. In the popular usage, the group 'Lilies' includes lily-like plants also. For instance the 'Tiger' lily is a true lily, while the 'Spider' lily (*Hymenocallis*) or *Sprekelia* or *Agapanthus* are only lily-like plants. The cultivation practices of lily-like plants differ with varieties. But some general observations regarding true lilies are possible.

In true lilies the bulbs are composed of many overlapping scales above a central axis and the bulbs are not enclosed. The flowers are borne at the end of the stem emerging from the centre of the bulb. The leaves are long and narrow and start at some distance from the ground.

The flowers of lilies have 6 petals with equal number of stamens and anthers. The petals are like a trumpet as in 'Madonna' lily or with tips recurving backward as in 'Tiger' lily or with open flowers as in *L. umbrellatum*. Most of the lilies form a new bulb at the centre of the old one and small ones at the base while there are others which form the new bulbs at some horizontal distance connected by an underground stock.

Planting. Depth of planting is a critical factor for the lilies. Some lilies root only from the base of the bulb while others root also from the stem, under the soil but above the bulb. Stem-rooting lilies are planted deeper than those rooting at the base. A good depth for stem-rooter lilies is 15 cm (6 in.) and for the base-rooters 7.5 cm (3 in.). 'Madonna' lily does well if planted only 2.5 cm (1 in.) deep. For conserving moisture, stem-rooter lilies should be given a good mulch of semi-decayed leaves.

Bulbs should be planted just before growth commences. The rest period is generally for about two months after flowering. The best time to plant is when they show sign of growth after the rest period. They are generally planted in February-March in the hills and in September-October in the plains.

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Cultivation. The leaves, flowers, stems and stem-roots of lilies die annually but the basal roots have a longer life. These basal roots start their function immediately after planting. Therefore, lilies should not be disturbed once they are planted till they are overcrowded or it otherwise becomes necessary to do so. The bulbs to be purchased or gifted should have their basal roots intact. If these roots are trimmed, damaged or dry, there is a risk of the bulb not rooting at all, and gradually withering away. The scales of the bulbs should not be rubbed away; they may be allowed to fall off naturally.

The lilies generally prefer semi-shade or morning sunshine. The 'Madonna' lily is an exception and grows well on the south side. They are reported to thrive well in the direct sun, provided their roots are kept moist and cool, while the flowers have the benefit of the full sun. The lilies enjoy moisture but not 'wet feet' which causes rotting of bulbs. They need protection from hot or cold winds.

The lilies rejoice in leaf mould and dislike heavy manuring. It is better to grow them in a plot manured in the previous season with the addition of leaf mould in the current season. They also benefit by addition of wood ashes @ 8 oz/yd². If lilies are grown amongst rhododendrons or azaleas, wood ashes which have alkaline property should not be added. Most of the lilies are reported to like the soil with a pH of about 6. The 'Madonna' lily, as an exception, is fond of lime. The soil should be well drained with capacity for retaining moisture.

The lilies should not be allowed to overcrowd themselves as each one competes with the other as if to show off its personality. About 8 bulbs/m² is a good number.

Pests and diseases. The most common disease of lilies is bulb-rot. Aphids, lily beetles, stem borers and thrips are the common pests.

Lilies for the hills and the plains. In the plains only *Lilium longiflorum* thrives. In the northern plains, *Lilium tigrinum* also flowers in winter. I saw very healthy plants of Tiger lily in the National Botanical Gardens, Lucknow. The other lilies can be cultivated only in the hills in India.

Select species. A very large number of species and varieties of lilies are available. Only a few of them are discussed below as selected samples known to the author:

L. tigrinum. Orange colour, spots purple black, blooms in July-August in the hills and January-February in the plains. Height 1-1.5 m (4-5 ft); stem-rooting, prefers semi-shade; flowers recurving. Can be very easily multiplied from the small black bulbs called 'bulbils' which appear in the axils of the leaves. When fully formed in September-October, they may be detached and sown. They bloom in two years. There are single and double varieties.

L. regale. One of the most beautiful and fragrant lilies with white trumpet-like flowers, with tips stained with yellow inside and purple on the outside. Blooms in July in the hills. Height 1.2 m (4 ft), stem-rooting, semi-shade. Can be grown easily from seed. Flowers in two years if raised from seed. Pods may be kept on the plant till ripe. Seeds may be dried and sown in March.

L. auratum (Golden-rayed lily of Japan). This can perhaps be called the 'Queen of

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the lilies'. It is beautiful and fragrant. It bears trumpet-like white flowers with yellow streaks in the centre, like the sun rays. The purple black spots present a beautiful contrast with white and yellow. It can be noticed from a long distance. Stem-rooter; height 1-1.5 m (4-5 ft); flowers in May-June.

L. candidum (Madonna lily). Base rooter; height 1.2 m (4 ft); loves sunshine; pearly white; trumpet-like flowers; sweetly fragrant; needs shallow planting; flowers in May-June.

L. longiflorum. Stem-rooter; flowers in January-February in the plains and May-June in the hills; flowers trumpet-like, of pure white colour and fragrant. In the plains, the bulbs need to be lifted every year and planted in September-October. The height attained is only 60-90 cm (2-3 ft) in the plains and about 1-1.2 m (3-4 ft) in the hills.

L. speciosum. Stem-rooter; height 1-1.5 m (4-5 ft), flowers recurving, pink colour with deep crimson black spots, beautiful and fragrant. Bright mustard-yellow coloured anthers present an attractive contrast with pink spotted petals; flowers in June-July.

L. umbrellatum. Stem-rooter; height 60 cm (2 ft), differs from usual lilies with terminal clusters of flowers facing upwards; flowers do not recurve; blooms in shades of red, orange, yellow; flowers in May-June.

BEGONIAS

The begonias can be divided into three groups: tuberous, rhizomatous and fibrous rooted. Except for some fibrous-rooted ones, the others do well in the hills only. They have separate male and female flowers on the same plant.

The tuberous begonias are one of the showiest flowers in numerous shades of red, scarlet, crimson, orange, apricot, yellow and white; single and double; self and picotee (i.e. dark edges). One would fall in love with them. The rhizomatous begonias to which *B. rex* also belongs, provide one of the most varied and colourful foliage plants with almost metallic tones in the shades and combination of greys, browns, greens, copper and bronze and red; single and multi-coloured; spotted and speckled; velvety and rough texture. Many of them make attractive pictures against the light when the red or yellow veins glow. One would like to show them off. The fibrous-rooted ones are the gay little ones which seem to enjoy themselves always and everywhere. One would like to play with them.

The tuberous begonias are particular about their position, place and moisture requirement. They like shady position. I prefer to keep them to get the morning sunshine only for a couple of hours. They are usually propagated from tubers as the name suggests but can also be multiplied from cuttings. Unfortunately the choice varieties give very few cuttings. A tuber may be allowed to develop a healthy bud before taken out and put in a pot 20 cm (8 in.) or so filled with leaf mould 2 parts, loam 1 part, and cowdung manure 1 part with a handful of sand mixed well. Place it 3 in. below the soil level and keep it dry till a pair of leaves shows above the mixture. Start watering, keeping it moist

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and not wet. It has a tendency to rot due to over watering or watering before a pair of leaves develops. The best policy with them is neither too dry nor too wet. After the foliage dies, they are normally taken out of the pot and stored in sand.

The most handsome of the rhizomatous begonias are *B. rex* and, therefore, the former have popularly come to be known as *B. rex*. They can be easily propagated from leaf cuttings. A leaf with about 2.5 cm (1 in.) is placed in sand or a mixture of sand and leaf mould (no manure or soil), and firmed down with the help of bamboo pins or toothpicks. Cut the main veins only with a razor blade or a sharp knife, keep the mixture moist with a fine sprayer. Tiny plants will be formed where the veins are cut. Detach them when about 2.5 cm (1 in.) in size. Plant them separately in a mixture of half sand and half leaf mould. When roots are formed, the plants can be transferred to their regular pots. The leaves can be rooted in water also. African violets can also be propagated in this manner.

The fibrous-rooted begonias can be propagated easily by root division. One of the finest species in this group is *B. semperflorens*.



38. *Gloriosa superba*



39. *Dahlia*, a large decorative



40. *Iris kumaonensis*

41. *Sprekelia*



42. *Lilium tigrinum*





43. *Tulipa*, deserves to be popularized more



44. Bougainvilleas, a riot of colour



45. An arrangement of climbers — *Vernonia*, *Monstera deliciosa* and *Philodendron*



46. A creeper (*Clerodendron splendens*) on a pergola

47. *Monstera deliciosa*



48. A *Philodendron* trained on a log of wood with moss



9

CLIMBERS

C LIMBERS like flowering and evergreen shrubs are an essential part of garden designing. They may be used as a background on a wall for showing off the herbaceous border or to soften the horizontal or vertical lines of architecture. They may be used on pergolas with a seat underneath, for a personal corner for relaxation. Or still another use may be to dress an ugly corner. They may also be used as a screen or for dividing one portion of the garden from the other.

Climbers may be annual, like morning glory, *Ipomoea versicolor* (*Mina lobata*) or Canary creeper, or perennial like bougainvillea or rambler roses. They may be for a shady or semi-shady location or for the sunny corner. They may be preferred for their foliage or flowers or berries. The flowers can be single coloured or bicoloured. One of the prettiest bicoloured flowers is *Ipomoea versicolor* (*Mina lobata*) with its scarlet and yellow spiky blooms in profusion. The climbers may be light like jasmine, *Asparagus* or climbing *Nasturtium*, or heavy like *Monstera* or *Clerodendron splendens*. They may be chosen for their scented flowers like jasmine, roses, or honey suckle. Some might be favoured because of the ease of cultivation like pothos (*Scindapsus aureus*) popularly known as money plant. A climber may also be favoured for its quick growth and in this respect there is none to beat the railway creeper (*Ipomoea palmata*) which grows fast even on indifferent soil. A climber like *Petrea volubilis* gives not only numerous sprays of pretty mauvish blue flowers but also unique material for flower arrangement when its wavy branches are pruned. *Derris scandens* with its long wavy stem without foliage is a delight for the artist.

Climbers required for a screen should have thick foliage and be fast growing. If you have an ugly drain-pipe in a shady position, you may like to try *Trachelospermum jasminoides*. *Monstera deliciosa* grows well in shady place. *Scindapsus* weaving its way to the tree top with an undergrowth of shade-loving plants like *Ruscus*, *Pilea muscosa*, *Philodendron*, *Alocasia*, *Dieffenbachia*, *Tradescantia*, *Anthurium*, *Maranta*, *Calathea*, *Aglaonema*, ferns and *Selaginella* make a very refreshing cool corner.

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A combination of climbers blooming successively or simultaneously also can create a delightful effect. *Clerodendron splendens* with its scarlet flowers and dark green broad foliage matches beautifully with the white bloom and small foliage of *Jasminum pubescens*.

On a wall along the compound away from the house, a climber of neutral type like ivy or *Vernonia* which will not clash when the herbaceous border is in bloom, would be a good choice. *Pyrostegia ignea* (previously known as *Bignonia venusta*) which is in bloom in January-February may be used as a background provided the flowers in the border are of such colours as not to clash with its bright orange colour. *Calendula*, *Nasturtium* and orange *Dimorphotheca* may be planted beside it. A very attractive corner can be created with *Pyrostegia ignea* overhead and wall flowers underneath. Rambler roses with proud Madonna lilies can be the pride of a garden. The fallen petals or bracts of some of the creepers like bougainvillea provide a lovely carpet effect.

Climbers can likewise provide a beautiful backdrop for the water-garden. I once saw a very pretty corner with magenta-rose bougainvillea in the background, pink *Acroclinium* in the front flower bed and lotuses in bloom in the tank – all in lovely shades of pink with different forms and shapes of foliage and flowers.

Climbers are an excellent cover material and act as insulators for the greenhouse. Orchids which hate the dry hot climate of Delhi would thrive under heavy shade of the climbers provided they are kept moist. A beautiful and utility screen can be made of *Dolichos lablab*, a delicious runner vegetable. If you like a climber which would hang like aristocratic drapery, choose *Vernonia elegnaefolia*. If you like one for the delicate beauty of its flower there is really none to beat *Petrea volubilis* in the plains, and *Wistaria sinensis* in the hills. Unrivalled in fragrance are *Jasminum grandiflorum*, honey suckle and *Hiptage madablota*. A climber which grows wild and is very common in gardens in Shillong is the white *Rosa indica*. It is a spectacular sight towards the second half of March and goes up to 15-20 m (50-68 ft) or so.

An orange tree had to be saved in our 'Lumpyngnad' house at Shillong from a foliage climber *Raphidophora*, whose rhizomes had taken deep roots on the branches of the tree. There was no way of disentangling these rhizomatous roots and those branches had to be cut off. The leaves of the climber resembled those of *Philodendron* and we called the whole operation as 'Operation Philo'. This climber is very vigorous and goes up high on big trees as high as 15-20 m (50-67 ft).

Climbers for the plains and the hills. The climbers suitable for the plains and the hills are grouped below according to their main season of flowering.

The Plains

Summer and/or rains

Winter

Adenocalymma
Allamanda

Beaumontia grandiflora
Bignonia venusta (*Pyrostegia ignea*)

CLIMBERS

Antigonon leptopus
Aristolochia elegans
Campsis chinensis
Clitoria ternatea
Derris scandens
Gloriosa superba
Hiptage

Ipomoea learii
I. palmata
Jasminum grandiflorum
J. officinale
Lonicera japonica
Passiflora caerulea
Quisqualis indica
Trachelospermum jasminoides

Clerodendron splendens
C. thomsonae
Ipomoea rubrocaerulea
I. learii
Jasminum primulinum
J. pubescens
Petrea volubilis
 Climbing roses

Thunbergia
Tropaeolum canariense
Wistaria sinensis

In addition, the foliage climbers *Asparagus plumosus*, *Monstera deliciosa*, *Philodendron*, *Scindapsus* and *Vernonia*, mentioned in this chapter do well in the plains.

The Hills

Spring and summer flowering

Campsis chinensis
Clematis
Gloriosa superba (Honeysuckle)
Ipomoea versicolor
I. tuberosa
Jasminum grandiflorum
J. officinale
J. primulinum
Lonicera japonica
 Rambler roses
Solanum jasminoides
S. wendlandii
Wistaria sinensis

Winter flowering

Beaumontia grandiflora
Pyrostegia ignea

In addition, all the foliage climbers mentioned in this chapter do well in the hills.

Climbers for shade. For the shady places, *Trachelospermum* and the foliage climbers mentioned in this chapter except *Ficus repens* and *Hedera helix* are likely to be suitable.

Climbers as annuals. The climbers mentioned here, which are annuals or can be grown as annuals, are *Clitoria*, *Gloriosa*, *Ipomoea rubrocaerulea*, *I. versicolor*

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(*Mina lobata*) and *Thunbergia*. They can be used to cover quickly any ugly corner or in combination with deciduous climbers.

Most of the climbers mentioned are evergreen. The deciduous ones are *Pyrostegia ignea*, *Clematis*, *Hedera*, *Jasminum primulinum* and *Tecoma* (*Campsis*). The foliage of *Asparagus plumosus* and *Gloriosa superba* die in winter.

Colour of flowers. The climbers may be grouped according to colour of flowers as follows:

White. *Beaumontia grandiflora*, *Derris scandens* (pinkish white), *Jasminum grandiflorum*, *J. officinale*, *Solanum jasminoides*, *Thunbergia* sp., *Trachelospermum jasminoides*.

Cream. *Aristolochia elegans*, *Clerodendron thomsonae* (with crimson corolla), *Hiptage*, *Lonicera japonica*, *Passiflora caerulea*.

Yellow. *Allamanda cathartica*, *Jasminum primulinum*, *Ipomoea tuberosa*, *Tropaeolum canariense*.

Mauve, pinkish-mauve and pink. *Adenocalymma*, rambler roses, *Solanum wendlandii*, *Wistaria sinensis* (lavender blue).

Rose. *Antigonon leptopus*, *Quisqualis indica* (white to pink to rose), rambler roses.

Blue, indigo blue. *Clitoria ternatea*, *Ipomoea learii*, *I. palmata*, *I. rubrocaerulea*, *Petrea volubilis*.

Orange, scarlet and crimson. *Bignonia venusta* (orange), *Clerodendron splendens* (crimson), *Gloriosa superba* (change from yellow to scarlet), *Tecoma chinensis* (terracotta orange), *Ipomoea versicolor* (change from scarlet to yellow).

Clematis and *Bougainvillea* are in many colours.

BOUGAINVILLEAS

'If you want to feel rich, grow bougainvilleas'. The bougainvillea has richness of colour to suit different temperaments. Except perhaps for true blue, it has all tones of colours ranging from the white or snow-white of 'Shubhra' to golden yellow of 'Lady Mary Baring' or pale cherry red of 'Tomato' to the bright crimson of 'Dr R.R. Pal'. There are bougainvilleas with variegated leaves as in 'Thimma', 'Louise Wathen Variegata', 'Dr Rao', 'Bhabha', 'Archna' or 'Scarlet Queen Variegata'. Originating from South America, the bougainvilleas have established themselves well in India in the tropical and sub-tropical regions. In the hills, the common variety, which is most vigorous and is found to climb top of the huge trees, with its magenta bracts is reported to be *Bougainvillea glabra* Choisy. There are single and multi-bracted varieties and some attractive bi-colour ones. The varying depth and tone of rose-pink, coupled with white, of 'Wazid Ali Shah', gives it a romantic look.

Propagated from air layering or cuttings, the bougainvilleas are favoured for their colourful bracts. The true flower is quite insignificant. Air layering is done in the rains.

The bougainvilleas love plenty of sunshine. Overwatering or over-manuring

should be avoided otherwise there will be more leaves and less of colourful bracts. The soil should be well drained. Pruning is required mainly for shape. It may be done in May in the northern plains. Pruning in winter is forbidden, as it will lead to more leaves and less bracts. March is considered to be the peak period in north Indian conditions. Another flush appears in the rains. Watershoots, more frequent in the rains, should be removed.

Bougainvilleas do well in the pots also. They thrive and flower better in comparatively pot-bound condition. The compost may be 2 parts soil, 1 part leaf mould, 1/2 part farmyard manure and 1/4 part sand. Bonemeal is beneficial. Water the plant only when it is dry.

The multi-bracted bougainvilleas are of recent origin. Some of these well-known varieties are 'Roseville's Delight' (change of colour from pale off-pink to autumn russet pink), 'Mahara' (magenta-crimson), and 'Cherry Blossom' (russet pink and cream—extremely attractive).

Some of the popular single-bracted varieties are:

Bi-colour and multi-colour. 'Archna' (variegated leaves, white and magenta-bracts), 'Begum Sikander' (white and touch of rose), 'Chitra' (very vigorous, striking with off-white and red), 'Mary Palmer' (white and magenta), 'Thimma' (a sport of 'Mary Palmer' with variegated leaves, white and magenta-bracts), 'Wazid Ali Shah' (white with varying shades of pink, rose and magenta).

White. 'Dr B.P. Pal', 'Shubhra', 'Snow Queen'.

Yellow and apricot. 'Blondie' (luminous light peach-apricot), 'Bois de Rose' (unusual pale biscuit with green veins, strikingly pretty). 'Lady Mary Baring' (mustard yellow, has reigned supreme in this colour).

Mauve, pink, rose. 'Dream' (pale mauve), 'H.B. Singh' (lilac mauve — very attractive, short, naturally trained), 'Mrs Buck' (rosy magenta, looks translucent in sunshine), 'Maharaja of Mysore' (mauvish rose), 'Trinidad' (very pale lavender).

Coral, orange and scarlet. 'Isabel Green Smith' (rose-orange), 'Enid Lancaster' (yellow changing to yellow orange), 'Louis Wathen' (a flame of coppery orange).

Magenta, red and crimson. 'Mrs Butt' (crimson), 'Dr R.R. Pal' (vigorous, very attractive), 'Rosea Fuchsea' (Fuchsea rose), 'Scarlet Queen' (deep crimson), 'Sensation' (mass of lovely bright magenta-purple), 'Singapore Red' (dark green leaves contrasting beautifully with crimson red), 'Tomato' (dull cherry red).

SELECT LIST OF BEAUTIFUL CLIMBERS

Flowering climbers

Adenocalymma. It is closely related to the *Bignonia*. Two species, *A. allicea* and *A. calycina* are cultivated in tropical India. They grow better in moist conditions. They are evergreen, and the shining leaves have the odour of garlic. *A. allicea* appears more showy when the pink-mauve flowers in large clusters appear profusely during October-

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December; a few more flushes appear in early spring. *A. calycina* bears large velvety yellow flowers during March-July. Propagated from layers after flowering in March-April or in the rainy season. Propagated also from the side shoots.

Allamanda cathartica. Deciduous. Very popular for its bright green attractive foliage and shiny yellow trumpet-shaped flowers produced in profusion over a long period during summer and the rains. Quick and easy to grow from cuttings or rootlets. After flowering gives new growth, useful for making cuttings. Grows in tropical and sub-tropical areas only. With its straggling growth habit and semi-climbing and semi-shrub nature, it can make a pretty umbrella, or trained to the top of a pillar or a pergola or it can be trimmed as a round shrub or left as a weeping shrub. A good cut-flower. *A. violacea* has dull purple-pink colour and is distinctive for its unusual colour only. It is less vigorous than *A. cathartica*.

Antigonon leptopus. A deciduous sprawling creeper with beautiful rose-coloured flowers like tiny gooseberries with their husks, borne on delicate spikes produced almost throughout the summer and the rains. Very fast growing, of untidy habit, needs training and hard pruning after the winter in February-March. A good cut-flower. There are also varieties in white or pale pink colours, and can be propagated by cuttings or rootlets almost throughout the year. This plant which should be the 'spokesman' of the garden plants is often subjected to utter neglect, but it is too gay to protest. It can become a pest, if not kept under control.

Aristolochia elegans. The creeper deserves selection because of the very unusual form of its flowers and is popularly known as 'Calico Flower', or 'Dutchman's Pipe', etc. The flowers are greenish cream with purplish veins on the outside and purple mottles inside. Blooms in the rainy season. Raised from seeds planted in the beginning of rains or from cuttings taken in the rains. Grows in a sunny position. Suitable for plains. I once saw a very beautiful display of this climber growing on a trellis along both sides of a garden path. This species is odourless, though most of the *Aristolochia* species do not find favour because of the unpleasant smell of the flowers. Needs practically no pruning.

Beaumontia grandiflora. Its virtues are fast growth and abundant, lightly scented, trumpet-shaped white flowers looking like *Lilium longiflorum*. It is at its best in February in the northern plains, and in March in the hills. It is popularly known as the Nepal (Trumpet) Creeper and grows from Delhi and Calcutta in the plains to the hills about 1,500 m (5,000 ft). Grows best in a sunny position, shows itself well climbing up tall trees or trained along the walls and up the pillars. Should be pruned after flowering. Propagation is from cuttings after flowering.

Bignonia venusta. Renamed as *Pyrostegia ignea*, it is a climber with beautiful tubular orange flowers. Can be seen covering large wall areas in January-February. Very fast growing and free flowering. Propagation is generally by air layering. It can also be propagated by cuttings after flowering but takes too long a time. Though a plant of the tropics, it grows well at Shillong 1,500 m (5,000 ft) and Bangalore, 1,000 m (3,280 ft). Rashtrapati Bhavan and Talkatora Garden walls in New Delhi are a striking splash

of colour with this climber in January-February. It flowers equally well on the south side as on the east or west and likes a sunny position. Needs practically no pruning. I have seen this creeper beautifully trained from one side of the entrance of a flat to the other over the rim of the doors and windows like an orange border. Underneath grew luxuriant 'Super Star' roses. It was indeed a rare sight. There are other beautiful species of *Bignonia* too. Some of them have been later classified into other genera. One of them which needs special mention is the former *B. gracilis* now classified as *Doxantha unguis-cati*, with a mass of yellow trumpet-shaped flowers with no leaves in sight in March.

Clematis. Belonging to the family of *Ranunculus*, it is one of the prettiest deciduous light climbers for a sunny position in the hills. Some species do well in the plains also, where they are reported to be evergreen. Propagated mainly by layering. Needs to be popularized more. Needs training and pruning. Some species flower on the current year's growth, while others flower on the last year's growth.

Clematis jackmanii. It is one of the prettiest of the largest-flowered types. It is vigorous in growth and bears blooms in profusion from July to October. It flowers on new growth and needs vigorous pruning. The flowers are violet-blue, mauve, and mauve-pink. *C. lanuginosa* and *C. patens* are also large-flowered types. *C. lanuginosa* is reported to flower on new growth, *C. patens* on old wood.

Only the species *C. flammula* and *C. paniculata* are reported to do well in the plains. They flower in the rains and have white, star-shaped flowers. They flower on new growth and need pruning of old shoots after flowering. *C. flammula* has exquisite scent, *C. paniculata* is also scented. *C. alpinia* is a pretty climber with bell-shaped flowers of violet-blue colour in the spring.

Clerodendron splendens. One of the showiest climbers of the plains with its scarlet clusters of flowers contrasting beautifully with deeply-veined blackish-green foliage in January-February. Does better in a position with morning sunshine. Its flowers are followed by brown-red berries, very attractive for flower arrangement. Usually propagated from suckers and sometimes by layers. It is a thick and a heavy climber. The climber, because of its lush green foliage, looks pretty even when not in bloom provided the plant is sprayed with water to remove the dust, which so easily settles in Delhi. Needs practically no pruning, but a thorough clearing of dead leaves and undergrowth at the beginning of the rains.

Clerodendron thomsonae. One of the prettiest climbers, the flowers with their cream-white calyces and crimson corollas are produced in the spring. Popularly known as 'Bleeding heart'. It is lighter and less vigorous than *C. splendens*.

Clitoria ternatea. An evergreen perennial, it is usually cultivated as an annual from seeds. Sown in early summer, bears beautiful single or double indigo blue mauve or white flowers for most part of rainy season and winter. It is a light creeper for a sunny position. It is known as 'Aparajita' in Indian languages. Plants grow from the seeds fallen during the previous year.

Derris scandens. A vigorous, evergreen, effective climber which produces in the

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rains pinkish-white flowers in racemes. The climber is distinctive because of its beautifully wavy stem and also pretty bloom. Propagation from seed or layers. Needs heavy pruning after flowering.

Hiptage madablota (Madhaviyata). A vigorous growing evergreen climber of dark green smooth foliage. Popular for its exquisitely fragrant flowers. Popularly called 'Madan Masta', i.e. one which can even intoxicate Cupid, the God of Love. The flowers have four greenish white petals and one smaller golden-coloured one contrasting beautifully with the others. It is easy to cultivate and is at its best in February-March in a sunny position. Does well in the plains only.

Honey-suckle (Lonicera japonica). A favourite climber for its ease of cultivation, vigorous growth, neat habit of growth, exquisitely fragrant and pretty flowers and dark green small-leaved foliage. The buds are dull yellow-orange and tubular shaped and when they open the flowers are waxy white. They turn yellow as they become old. The combination of yellow, cream and white in abundance makes the climber look very pretty when in bloom in summer and the early rains. Does well in positions with the morning sunshine or in partial shade. Looks very attractive if trained along the trellis of a verandah. It can also be allowed to go up a small tree. Needs pruning after flowering and can be easily propagated from cuttings taken in the rains.

There is a species, *L. sempervirens*, with scarlet flowers which look pretty but is without fragrance and cannot displace *L. japonica* from its pride of place.

Gloriosa superba. It is a rhizomatous climber. Though not a true lily, it is known as the glory lily because of remarkable resemblance of its leaves with those of the true lilies and some resemblance of the flowers. The flower has six petals as in lilies, though the arrangement of the petals is unusual. The petals are frilled. The colour combination in the flower is similar to that in *Ipomoea versicolor (Mina lobata)* with the difference that the bud is yellow. When the flower opens the tips of the petals only are scarlet and gradually the whole flower becomes a smashing scarlet with just a touch of golden yellow at the centre from which orange anthers dart out.

In *I. versicolor* the flowers are scarlet first and gradually turn to orange and yellow.

The plant dies at the beginning of winter. It can be multiplied by dividing the rhizomes at that time or in the early spring in March-April. As in the case of lilies, care should be taken not to injure the roots while dividing and during transplanting. Can be raised from seed also, in the plains. In the hills it flowers during May-July, and in the plains, in July-September. Plant attains height up to $1-1\frac{1}{2}$ m (4-6 ft). A very beautiful and slender climber. Can be grown as an annual. It is susceptible to the black caterpillar pest.

Ipomoea. This genus belonging to the *Convolvulus* family includes a number of species; some of them remain open only for the early part of the day, others remain open for most part of the day while there are others like *I. versicolor* which do not close. There is still another which opens at night. One of the most popular ones is the Heavenly Blue Morning Glory (*I. rubro-caerulea*). It is a perennial cultivated as an annual climber

grown from seeds sown in September-October. Starts bearing in 40-50 days a mass of heavenly blue trumpet-shaped flowers with creamy white centre. The flowers open in the morning and close by the afternoon and wither away. New flowers open the next day. But loss of old ones is not missed as the flowers are produced in profusion during the whole of the rainy season. Very easy to grow. Prefers a position with morning sunshine.

I. learii is one of the finest flowering climbers for the plains. A quick-growing almost evergreen plant which can cover a very large area. Large, bell-shaped, deep blue flowers arise in axillary clusters of 10-20 and open in succession almost throughout the year.

I. palmata known as Railway Creeper because of its vigorous growth in the shortest possible time, is popular with the Indian Railways as a screen. It bears mauve flowers throughout the rains. It is an evergreen climber but is susceptible to frost in Delhi in winter. It comes up again as soon as the weather warms up.

I. tuberosa. A perennial creeper popularly known as 'Wood-rose' creeper. Does extremely well in Bangalore. It bears yellow flowers of funnel shape. The fruit when ripe, opens up like a rose and is of wood-brown colour. It is very popular for floral arrangement. Propagated from seed.

I. versicolor (Mina lobata). This is the prettiest of the *Ipomoea* creepers for the hills. In the hills the seed is sown in March-April, grows vigorously and in a season develops root system as deep as 60-90 cm (2-3 ft) with stems as thick as 5 cm (2 in.) in diameter with prolific foliage. Starts blooming in July-August and continues till Diwali, i.e. up to about the middle of November when it dies due to severe cold. In the plains the seed is sown in August-September and flowers up to the end of winter. The flowers are borne on spikes. The bottom flowers of the spike are scarlet, middle ones orange and the tip is light yellow. The variegated, delicate-looking, flower spikes produced in masses look extremely pretty. It does better in the hills than the plains.

Jasminum. A genus with most exquisitely fragrant shrubs and climbers, usually referred to as jasmines. There are a few exceptions which are without fragrance. The choicest climber is *J. grandiflorum*. Its leaves are larger and flowers are smaller, but produced in such profusion and with such fragrance that it just is a 'must' in a garden. Flowers are single star-like of five petals in white. Flowers throughout the summer but is at its best at the beginning of summer in March-April. Does well in the plains and hills up to at least about 1,500 m (5,00 ft). Some beautiful specimens can be seen at the Sim's Park at Wellington near Ootacamund. Looks very pretty on a trellis, as an umbrella, trained as shrub with a frame or along the side of the wall, particularly if it is an exposed brick wall. It needs pruning in the beginning of the winter. Propagation from cuttings is taken at that time. In the hills, propagation by cuttings takes about a couple of years to establish a plant. It also needs protection like a roof projection, and is not able to stand direct heavy frost. *J. officinale* is slender looking with smaller and darker foliage. Its flowers are like *J. grandiflorum* though not so strongly scented. *J. primulinum* has bright yellow primula-coloured flowers without scent. Its mass of flowers, without

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leaves, is a glorious sight in Shillong in January-February, when there are no other flowers in the garden. *J. pubescens* is perhaps the sturdiest of the species, grows to its best even under conditions of neglect. The flowers are white with a touch of dull purple pink underneath. They are not fragrant but are produced in such profusion that in February the plant from bottom to top is a white sheet. Some extremely beautiful specimens can be seen at the Buddha Jayanti Park in Delhi. One of them climbed up a tree and shed its mass of petals which looked like a white carpet with a purplish pink hue. Growing in the Qutub Minar Gardens, its forlorn abundance is touching. It looked gay and cheerful in the Delhi University Gardens climbing on the fence with its companion *Clerodendron splendens*, their foliage beautifully contrasting and their white and scarlet flowers intermingling with each other.

J. sambac, known as *mogra* or *motia*, is perhaps the most popular shrub in India. It bears single or double lovely fragrant flowers in the summer and in flushes throughout the rains. It can be trained as a semi-climber. Very easy to grow from cuttings or root division. Prune in the beginning of winter in October-November.

Passiflora. An evergreen vigorous perennial, favoured for its unique soft very attractive flowers in profusion, quick growth and ease of cultivation. It is popularly known as 'Passion flower'. It flowers during the rains and is propagated by seed, layers or cuttings. It needs pruning after flowering. *P. racemosa* bears pretty red flowers but I consider *P. caerulea* as unsurpassed in the delicate beauty of its flowers. The flowers have greenish white five sepals and five petals and numerous filaments over the petals like rays and on the top sitting majestically are five anthers. It is also known as 'Kaurava and Pandava' because of five anthers on the top and numerous rays which look as if they are hundred. The rays in parts are of purple, white and mauve-blue. Thrives in the hills as well as the plains. The flowers are followed by fruits which are edible. *P. racemosa* does not thrive in the hills.

Petrea volubilis. Perhaps the loveliest climber of the plains, it produces beautiful mauvish-blue flowers in March, drooping in long racemes, which contrast strikingly with its rugged, brownish, wavy, gray stems. New leaves emerge with the flowers. It is surprising that such large coarse leaves and woody stems should produce such delicate masses of flowers. This beautiful plant provides relief to the brick-red building of the Willingdon Hospital Nursing Home in New Delhi. It is pruned in October-November and the plant without any leaf or flower looks artistic like a piece of wood selected for flower arrangement. Its stem can be used to make a very pretty lampstand. Some gardeners like to mix *Petrea* with other creepers to hide its woody stem but I would prefer to show the full grandeur of the bark and stem of the plant. Why deny yourself the pleasure of the natural floral arrangement. Because of its semi-shrub, semi-climber nature, it makes a showy standard also if trained on a bamboo or wire frame.

P. arborea is a pretty shrub, which grows as a tree in the West Indies.

Quisqualis indica. A distinctive creeper of the plains, it is popularly known as Rangoon creeper or *madhumalati*. It is of vigorous growth, capable of being trained in

any shape desired on walls, pergolas, arches or a trellis, or trained as a shrub with a wire frame. It produces sweetly scented flowers. The new flowers in the morning are white with shades of pink and co-exist with rosy pink older ones. By the evening all of them are rosy pink. Flowers are produced in abundance in the summer and the rains, though they continue to bloom off and on throughout the year. After the rains, it is better to prune it. It produces a number of suckers which may be used for propagation or removed.

Roses: Ramblers and climbers

Rambler roses are the most informal of the climbers in the hills. Their ease of cultivation, combined with profusion of bloom and adaptability to training in any form and size makes them great favourites. They love sunshine. They can be trained on pergolas, trees, trellises or walls; as weeping bush or a standard. The flowers are single or double and in colours of white, golden, yellow, mauve, pink, rose, carmine and magenta-red. The ramblers left to themselves reach the tree tops and bloom there lustily. They flower on last year's growth. They should be pruned back in the beginning of winter. The ramblers in the plains are miserable-looking specimens but do well in the sub-montane regions like those of Dehra Dun and Chandigarh.

Climbing roses include climbers as well as sports of HT roses. There are species and varieties suitable for hills as well as plains, but most of them do better in the hills.

A special mention needs to be made of the Banksian roses. While capable of climbing to a considerable height, they make lovely weeping standards as well as can be trained along the wall or trellis of the house.

I saw a beautiful combination at Shillong, in April, of all the three kinds of these roses—rambler, climbing and Banksian in colours respectively of deep rose, pink and lemon yellow trailing up a double-storey house.

Solanum wendlandii. A very beautiful deciduous climber which bears clusters of flowers in spring and early summer in the hills for 2-3 months. The pale green deeply dented foliage matches beautifully with the clusters of mauve-blue round flowers rising above them. The flowers, deep mauve in the beginning, turn to whitish mauve before fading away. Flowers on new growth. Needs pruning after flowering. It seems to enjoy a sunny protected position and loves moisture. It can also be trained as a shrub because of its woody, bushy nature. Suitable for the hills. Easily propagated from cuttings taken in the beginning of winter. It also forms tubers which can be utilised for propagation. They need not be lifted annually. The species *S. jasminoides* known as 'Potato creeper' is a lighter climber. It bears in the summer star-shaped jasmine-like flowers without scent, in clusters which look pretty among the dark green small leaves. Does very well in the hills. I have seen it doing well also in Gauhati in the Brahmaputra Valley.

Tecoma. A genus of many showy climbers and shrubs. Suitable for the hills as well as plains. *T. capensis* has dark green polished small-leaved foliage which bears small scarlet flowers mostly during the rains. The flowers cluster at the end of the branches. In

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the hills it climbs up on high trees and the bright flowers lurking in the foliage of the tree intermingled with that of the climber, look pretty. Grows in full sunshine as well as light shade.

A beautiful species, which was earlier placed under *Tecoma* as *Tecoma grandiflora* but now classified as *Campsis chinensis*, bears large terracotta-orange coloured flowers in profusion in May-July. Does extremely well in the hills in a sunny position. It gives fairly good display in Delhi and Gauhati also in August-September. The plant however is deciduous and shows its woody stems in the winter.

T. jasminoides, now classified as *Pandorea jasminoides*, bears white flowers with rosy throats, in the early rains. Grows well at medium altitudes and in the high hills. *T. stans* is a popular shrub.

Propagation of all these species is by cuttings taken after flowering.

Thunbergia. It provides a number of pretty evergreen climbers. It is usually grown as an annual. Suited for tropical and sub-tropical areas. *T. grandiflora* is a very vigorous climber with neat foliage easily reaching the roofs or covering pergolas. Flowers of pale blue colour with a creamish white centre are produced almost throughout the year, but mostly in winter. Likes a sunny position. I once saw a white variety. *T. grandiflora* var. *alba*, which was a mass of white flowers in early March in Hyderabad, and was so vigorous that though planted in the ground it clothed abundantly the pillars and even the roof of the first floor. Unchecked, it can be messy and straggly. There is another beautiful species, *T. alata*, of orange colour with dark purple centre called Black-Eyed Susan. There are white and pale-yellow colours also in this species. This is grown as an annual and is a light creeper.

Trachelospermum (Rhynchospermum) jasminoides. An evergreen climber with dark green leaves like *Lonicera* but more vigorous in growth. Its virtue is in its ability to grow and flower in shade. It bears fragrant masses of white flowers like jasmine, in the summer.

Tropaeolum. T. majus (climbing nasturtium) is a pretty light and low climber, flowers in December. It thrives in the hills only but is very susceptible to caterpillars in the rains. In spite of handpicking them often, the nuisance continues and the plant needs to be cut back. The plant resembles the dwarf nasturtium plant in flowers and foliage. It can be cultivated as an annual and propagated by seeds or cuttings. The rabbits love the leaves of nasturtium.

T. canariense known as 'Canary creeper' is also a very pretty climber with very light feathery pale-green foliage and bears bright lemon-yellow flowers. It thrives best on the hills but does well in Delhi in winter and the flowers can be seen in January-February. It is grown from seed as an annual.

Wistaria sinensis. One of the loveliest and showiest climbers of the hills, it is much prettier than the *Petrea volubilis* in the plains. The plant remains unnoticed until suddenly it bursts into lovely leafless mass of lavender-mauve delicate drooping clusters in profusion in April-May. Its gorgeous display, like waves of colour, with almost all

49. *Passiflora caerulea*



50. *Thunbergia alata*



51. *Trachelospermum jasminoides*



52. *Petrea volubilis*



53. *Pyrostegia ignea* (*Bignonia venusta*)



54. Bottle brush

55. *Erythrina crista-galli*



flowers open at the same time, remains only for a fortnight but it is well worth having a glimpse of such heavenly beauty. Likes protected sunny positions. I have propagated it only from rooted cuttings from the base of the plant. Needs heavy pruning after it is well established. A variety with white fragrant flowers, not so prolific in growth, was met in the lake at Shillong. It is no longer to be found.

Foliage climbers

Ficus repens. A slow-growing creeping plant which attaches itself to the support with its rootlets like ivy. Its small heart-shaped leaves are dark-green but the tender young ones in the rains are pale yellowish-green. They contrast beautifully with the mature dark ones. Grows well in northern plains and hills. Propagation from root cuttings. It can be beautifully trained into small pergolas or spheres as a pot plant as the ivy.

Hedera helix. The common English ivy is one of the prettiest climbers. Its leaves are thick, leathery, dark-green and triangular with marked veins. It creeps along the walls with its roots growing from the shoots. It grows only in the hills in India and grows fast from its stem cuttings with aerial roots. Can be trained into any desired shape as a flower basket, on a pillar or wall or as a hanging basket or on a wire cage or wire pyramid. It climbs up very tall old walls. Can be allowed to inter-twine with a tree foliage. Likes a sunny position. There are varieties with leaves variegated, mottled or marginated with greenish white.

Monstera deliciosa. It is the most popular of the monstera in India. A short-joint, thick-stemmed climber which throws up long aerial roots from the stem; with the help of which it can climb up high on the trees. It is slow growing, likes semi-shade and is a popular house plant. It has perforated and deeply cut, large, deep-green glossy leathery leaves. It is often confused with *Philodendron pertusum* but the latter is long-jointed and has no perforation. Its inflorescence is pretty like that of arum lily and the fruit of this species is edible and has jack-fruit aroma. The leaves if exposed to direct sunshine get bleached. Its roots become thick like snakes and can be frightening at night. Can be propagated from rhizomatous stem cuttings with or without aerial roots. Virtually needs no pruning. There is a variety with variegated leaves known as *M. deliciosa variegata*. There are other species with smooth leaves some with tiny perforation with no margin cuts, some with no perforation and very deep margin cuts.

Philodendron. A genus of very wide variety of evergreen climbers akin to *Monstera* which produce very decorative foliage and climb with the help of their aerial roots produced from the stems. It looks at its best if allowed to grow up a tree or trained on a log of wood covered with moss. The foliage is glossy and leathery of deep green colour, plain, variegated or mottled; with or without marked or shaded veins, and with or without cut margins. There are species producing beautiful flowers resembling arum lily or *Anthurium*.

The foliage may be deeply cut like *Monstera* with no perforation or smooth in some

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species resembling *Ficus elastica*, in others it may be like *Alocasia*, in still some others like *Arum* or *Anthurium*. In some cases the shape of the leaves is like pothos. There are species suitable for the hills as well as the plains. There are varieties with such marked variegation that the foliage has only a touch of green. Virtually needs no pruning.

Scindapsus (Pothos). Popularly known as 'Money plant', the belief is that if a cutting is stolen it brings luck and money; if borrowed or purchased, this does not happen. The truth is that it grows with such ease inside or outside the house in soil or water that one need neither borrow nor purchase but just 'pick up'. In places with high humidity it does not like to be kept too wet. The leaves are heart-like, shining and leathery like *Philodendron*. Plants do not mind remaining inside the room for months, provided they can get some light. They strongly protest against direct sunshine which bleaches them. There are species with variegated leaves. Allowed to grow on the trees, tiny delicate-looking plants assume unbelievably gigantic proportions. It is really the ivy of the plains. It climbs up with its aerial roots. Does not do well in the hills.

Vernonia elegnaefolia. It has an attractive growth by which it can be trained to cover the window sills or top of the house or terrace like numerous garlands hanging vertically parallel to each other. Its neutral colour of off-white blooms which are produced in February-March and pale-green foliage gives it an advantage as a background for colourful beds and pots in the front. It is vigorous in growth and can easily cover the whole wall of the house. Thus arranged, it looks like frilled drapery. It can be beautifully combined with other house plants like *Monstera* or *Philodendron*. A striking combination I saw in New Delhi was the pale green of this climber above and the purple of *Setcreasea* below. Adorned in new pale green cloak in July-August, in the plains, it is a refreshing sight.

Vitis himalayana. An extremely colourful creeper, reaching fantastic heights up to even 15-20 m (50-65 ft) displays its wealth of copper, burnt brick, rust and brown, maple colours in winter. It is found in abundance in the Khasi Hills. A very attractive specimen is in the Raj Bhawan, Shillong. It likes moist and cool atmosphere for the roots and open sunshine for the leaves. The colourful leaves when shed off make a lovely carpet and are replaced by fresh green ones.

10

TREES AND SHRUBS

TREES and shrubs are dominant elements of a home garden and contribute substantially to the garden atmosphere. They are available in many shapes, sizes, foliage and blooms. There are tall and columnar trees like, *Polyalthia longifolia* var. *pendula*, radiating uprightness and dignity, and the seductive *Magnolia* displaying of grace and grandeur. There are compact bushes like *Hydrangea* and *Azalea*, and feathery ones like *Cassia artimisioides* or flowering *Prunus*. There are plants with dark green leaves like *Rhododendron* and *Ilex* while others have striking variegation like the *Croton*. Leaves also change colour with the season — some very interesting specimens are the small tree fiddlewood (*Citharexylum suberratum*) or the shrub *Woodfordia* (*Grislea tomentosa*) which give a feel of the autumn in the spring. Some have round, globular forms at the top while others may be light and airy. There are some which would not be happy unless they get full sunshine while others would be partial to shade, particularly in the afternoon. There are some which flower once in the year like *Azalea* and there are others which flower for almost 6-8 months like *Plumbago*, *Vaccinium* or *Jatropha*.

SELECTION OF TREES

The selection of trees and shrubs would depend on the architecture of the building, the purpose for which required — whether a single plant as a focus of attention, or a mass of plants for effect; the position available — whether in shade, semi-shade or open sunshine; the situation whether near the waterside or near the rock plants — the desired colour effect and finally the location of the place, whether in the plains or in the hills. A graceful waterside tree is the weeping willow (*Salix babylonica*) with its long drooping branches reflecting in the water. In small gardens, it is better to avoid larger trees as the shade as well as drip are harmful for the plants. A good height is 3.5-4.5 m (12-15 ft.) — natural or trained, preferably natural. A plant like *Jacaranda*, *Cassia*

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fistula or *maulsari* (*Mimusops elengi*) which can be trained as a compact small tree is likely to have wide and deep spread of roots as compared to the one naturally small. If, however, you have a weakness for big trees, select those which are upright and columnar and, therefore, would not throw much shade on the plants underneath. The trees whose roots are deep rather than spreading may be preferred. Similarly, those which shed their leaves in winter would be better. If you fancy raising silkworms, you may include a mulberry tree.

CHOICE OF SHRUBS

Shrubs offer a wide variety of colour, shape, size and adaptability. A shrub, like a tree, may be grown as a focus of attention in a lawn or rockery, surrounded by mass of annuals, or in a herbaceous border some of these may be *Azalea*, *Buddleia*, *Camellia*, *Cassia artemisioides*, *Gardenia*, *Hydrangea*, *Ixora*, *Jatropha*, *Malpighia*, *Nerium*, *Lagerstroemia*, *Pentas*, *Plumbago* and *Punica granatum*. Shrubs may be grown collectively in a corner called the shrubbery, or a shrub-border. A carpet annual like *Tagetes signata* *pumila* or *Mesembryanthemum* grown as a border of the shrubbery lends it mass appeal. Lilies and other bulbous plants can also be grown inter-mixed with the shrubs. An evergreen low creeping plant like *Pilea muscosa* under a shrub breaks its (shrub's) aloofness. Some shrubs make attractive standards, like *Achania*, *Bougainvillea*, *Brya ebenus*, *Hibiscus* and even a nuisance like *Lantana*. Some can be grown as hedges like *Bougainvillea*, *Beloperone guttata*, *Buddleia*, *Daedalacanthus* and *Tabernaemontana coronaria* (*chandani*). Shrubs like azaleas and rhododendrons can be grown in a mass for grand effect. The shrubs may be evergreen or deciduous. They may be foliage shrubs, with very attractive leaves like *Acalypha*, *Aralia*, *Coleus*, *Croton*, *Duranta plumieri* var. *variegata*. *Nandina domestica* makes an invaluable shrub, as it has attractive foliage which blends well with floral arrangements. Shrubs can combine fragrance with beauty. *Magnolia fuscata*, *Gardenia* and jasmine will top this. *Francisea latifolia* with its mass of violet-blue, lavender and white flowers has soft lingering fragrance so also *Cassia artemisioides*.

PLANTING

Plant all deciduous trees and shrubs as soon as possible after fall of leaves, i.e. October-November or February-March. Evergreens may be planted in April in the hills or in the rains, i.e. July-August, in the plains. This time schedule is also applicable to transplanting from one position to another.

Pruning. The object of pruning of trees and shrubs is to retain good shape and promote growth of flowers besides removing congestion or dead wood. As a general rule, evergreens are not pruned, except for occasional shaping. For deciduous plants, pruning

56. A weeping willow, *Salix* by the water side



57. *Pinus wallichiana* (Syn. *P. excelsa*)



58. *Beloperone guttata*, a perpetual flowering shrub makes a colourful hedge also



59. *Buddleia madagascariensis*, a sweeping shrub and hedge plant



60. *Chandani (Tabernaemontana coronaria)*, a shrub



61. *Duranta plumieri variegata*, trained in three globose sections



62. *Hydrangea*, a grand shrub of the hills



63. *Juniperus*, a dwarf ornamental foliage plant

is according to their habit of growth. Those which flower on new growth, should be pruned immediately after the risk of frost is over in February-March. Those which flower on previous year's growth should be pruned immediately after the flowering is over. A safe rule for deciduous shrubs is to prune 2-3 weeks after the leaves are shed. In the plains the shrubs, which flower more or less throughout the year like, *Hamelia*, *Tecoma* or *Tabernaemontana*, are pruned at the beginning of the rains.

SOME CHOICE TREES

If your garden can afford the luxury of a tree, try some of the irresistible ones. *Acacia farnesiana* with its globular yellow soft-scented flowers intermingling with small green leaves; *Bauhinia variegata* with soft pink-mauve flowers or *B. blakeana* with purple flowers on a leafless tree; *Cassia javanica* with its soft rose-pink drooping flowers from the bottom to the top; *Nyctanthes* with its early morning carpet of white fragrant flowers with orange tubes, *Lagerstroemia* with its crepe like flowers displaying richness in dry summer and *Rhododendron arboreum* with its dark green leaves contrasting attractively with crimson red flowers, are some of the very attractive additional trees. One of the irresistible trees is *Tabebuia chrysantha* with its canary yellow leafless cloak in March-April. If I can afford two trees in my garden, I would choose *Magnolia grandiflora* and *Acacia podalyriaefolia* in the hills and *Cassia fistula* and *Tabebuia chrysantha* in the plains.

Amherstia nobilis. Evergreen, 10-12 m (35-40 ft). A truly noble tree with its flowers of vermilion colour edged with yellow drooping in racemes from the branches in March-May. Its tender leaves of copper colour, emerging simultaneously with the flowers and also drooping from almost every shoot of the tree, are a delight. Particularly attractive in March-April, suitable for moist warm climate only such as Calcutta, Trivandrum etc. Does not flourish in dry climate of north India.

Bottle brush (*Callistemon*). A medium evergreen tree, 8-10 m (25-35 ft). It is an excellent tree to be grown as a focal point of attraction in a sweeping lawn. It is rather slow growing and, therefore, particularly suitable for small gardens. It has a neat erect habit of growth with pretty foliage, crimson blooms and semi-pendulous branches. It is known as bottle brush because of a remarkable resemblance with a bottle brush of its cylindrical inflorescence in racemes of crimson colour with a tuft of green leaves at the end away from the stalk. It flowers in April in the plains and also sometimes in September-October. In the hills, blooms in May-June and November-December.

Flowering cherry (*Prunus serrulata*). Deciduous, 15-20 m (50-70 ft). A delight of the hills in November when the leafless artistic tree is bathed in flowers. Grows from 1,500 to 2,000 m (5,000 to 6,500 ft). It is a tree of startling beauty in the garden as a focal point of attraction and makes a lovely avenue tree also. The flowers are soft pink and its garnet-coloured tree bark glows in sunshine. The plains of India need not feel deprived of this beauty, because *Bauhinia variegata* with its soft coloured flowers almost of similar

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colour and shape is a pretty match. New plants grow easily from the seeds which drop. It is a favourite of the birds, specially the bulbuls, and is popularly known as bird cherry. There are many species and varieties, including the weeping cherries.

Chorisia speciosa. Deciduous, 8-10 m (25-35 ft). Bears lovely large flowers in September-October continuing up to November in clusters of mauvish pink when the tree is leafless. They contrast beautifully with the thorny brown-green trunk. It is fast growing and begins flowering in 5 years. Can be raised from seeds. It looks attractive in March-April also when new light green glistening leaves burst forth.

Erythrina. Deciduous. Common variety in the plains is *E. indica*, 10-15 m (35-50 ft). It bears in the summer vermilion-coloured flowers on a leafless tree. It is an excellent drought-resistant tree. In Gauhati it shows its full brilliance in March-April. In the hills a shrub *E. crista-galli* grows beautifully with its deep crimson blossoms in racemes in May-June. Propagation by 'heel' cuttings or air layers. Prune shoots close to old wood in October. Flowers on new growth. Loves a sunny protected position on the south side. Needs almost fortnightly pruning as it is prone to die-back. May be allowed to grow up to about 2-3 m (7-10 ft).

Grevillea robusta. Evergreen, about 20 m (65 ft). Known as silver oak because leaves are silvery white underneath. The silvery fern-like leaves fluttering in the air with almost the whole tree swinging lightly, is a gorgeous sight. It is neat, shapely tree with wide adaptability to climatic conditions. I have seen it growing well in New Delhi, Dehra Dun and Shillong. It bears a very pretty mass of mustard yellow flowers in April-May. While small, it is a pretty house plant and as it grows, a lovely focal tree and further on makes a beautiful avenue tree or even a wind-break.

Jacaranda mimosaefolia. Deciduous, 8-10 m (25-35 ft). The leafless tree covered with soft lilac blue, bell-shaped flowers in April-May is delicately pretty. Its light, airy foliage is equally attractive. Fallen flowers make a lovely carpet underneath. It has a wide range of adaptability and I have seen its glory in Ootacamund 2,000 m (6,500 ft), Shillong, 1,500 m (5,000 ft), Bangalore 900 m (3,000 ft) and Trivandrum (sea coast). Its broad flat seed pods are popular with children as clappers. I saw a tree which was trained as a bush to have foliage from the ground up to about $2\frac{1}{2}$ m (8 ft). It was an eye-catching sight as a point of attraction in a wide sweeping lawn. A fast-growing tree. I saw three-year-old plants in flower as tall as $2\frac{1}{2}$ m (8 ft).

Kadamb (Anthocephalus indicus). Evergreen, 15-20 m (50-65 ft). Even though a very large tree, I have mentioned it because of my fondness for it. A tree with dark, shiny green thick foliage, bearing lovely ball-like, cream turning yellow, very fragrant flowers in June-August. Even the round balls of seeds, which remain long, after the flower, look very pretty. A lot of Hindi poetry is woven round this tree. It sheds off a considerable amount of leaves in winter.

Laburnum, Indian (*Cassia fistula*). Deciduous, 6-8 m (20-25 ft). A pride of Indian flowering trees, bearing mainly in April-May pendulous racemes of bright yellow flowers of heavenly beauty. Almost leafless, bearing copper-green coloured new leaves

simultaneously with the bloom, it is a lovely sight. Occasional flowers continue till August. Its seeds covered in long black cylindrical pods and hanging from the branches also look attractive. They are also used for medicinal purposes. It is said that removal of these pods improves the flowering, but it is a very laborious process. Can be propagated from seeds or suckers. Its bark is lovely pinkish brown-yellow and the trees look distinctive even when not in bloom. A clump of three such trees at the entrance of India International Centre looks strikingly lovely.

I would like to try and train this tree as a bush with flowers from bottom to top by pruning it hard as mentioned for *Jacaranda*.

Magnolia grandiflora. Evergreen, height 6-8 m (20-25 ft). One of the loveliest and most majestic fragrant flowering trees. Its dark green thick leathery leaves, lighter underneath, and glossy green above bearing lotus-like butter-coloured waxy flowers in April-May easily steal one's heart. Its dry leaves are a pretty brown and dry petals are velvety brown – very effective for flower arrangement. If choice of only one tree is given, I would unhesitatingly take this in the hills. It provides shade, fragrance, beauty and grace. Unfortunately it is choosy about its growing conditions. It thrives best at higher elevations, 1,500 m (5,000 ft) but grows well enough at Dehra Dun 450 m (1,500 ft). I have seen pretty specimens in Guwahati (Assam) also. It is slow growing and remains within bounds of a small garden for many years. Propagation by air layering. Occasional flowers continue till August.

Maulsari (Mimusops elengi). A tree most irresistible for its fragrant tiny cream-coloured, delicate flowers which make the loveliest hairbands and garlands. Countless flowers drop under the tree and it is a pleasure to pick them up in the morning. The beauty of this tree also lies in its flexible shape. It looks very trim as a spherical tree with foliage from the bottom, as a conical tree with foliage starting from about half the distance or as a full grown extremely shapely tree. Some attractive specimens can be seen in IIT campus, New Delhi, and the Rashtrapati Bhawan.

Michelia champaca. Evergreen, 15-20 m (50-65 ft). The flowers in colours of greenish white or light golden yellow and borne in profusion in April-May and September-October are very sweet-lemon scented. The tree is popularly known as *champa*. A very common flower for Hindu religious festivals. A white flowering variety forms a smaller tree than the yellow one.

Plumeria. *P. acuminata* is a deciduous very common small tree found invariably near the temples for its ease of growth, fragrant pretty whitish yellow flowers with a tinge of rosy pink, drought resistance and long period of blooms. Popularly known as 'Temple tree'. *P. tuberculata* with its dark-green leaves and scented white flowers is very attractive. A good specimen can be seen at the India International Centre, New Delhi.

Polyalthia longifolia. Evergreen, 10-15 m (35-55 ft). It is commonly mistaken for the true Ashoka tree. Its variety *P. longifolia* var. *pendula* is very popular in the gardens for its foliage and the weeping conical shape of the tree with the foliage starting from the base of the tree. It can be grown as a tall hedge, or as a cluster of trees for a focal point of

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attention. It is drought resistant, and beautiful avenues of this tree can be seen in Bangalore. I have seen in Guwahati that it sheds off a large number of leaves and the new ones make attractive contrast with the older ones.

Punica granatum. Evergreen. The well-known pomegranate is an attractive small tree with scarlet flowers and leaves having a tinge of yellow, apricot, copper and burnt red. There is a very attractive ornamental double-flowered shrub also.

Saraca indica. Evergreen, 10-12 m (35-40 ft). This is the true Ashoka tree, bears

SELECT LIST OF TREES FOR THE PLAINS

| Name | Deciduous or evergreen | Time of flowering | Colour of flowers | Scented or not | Common method of propagation |
|--|------------------------|---|--|-----------------|------------------------------|
| <i>Acacia farnesiana</i> | Evergreen | Several times during year, mainly cold season | Bright yellow | Lightly scented | Seed |
| <i>Bauhinia</i> | | | | | |
| <i>B. purpurea</i> | Deciduous | November | Tones of rose and purple | Scented | Seed |
| <i>B. blakeana</i> | -do- | Dec.-Feb. | Purple crimson | -do- | -do- |
| <i>B. alba</i> | -do- | — | White | Scented | -do- |
| <i>B. variegata</i> | -do- | Feb.-Mar. | Rose, purple-white with spots | Scented | -do- |
| <i>Cassia</i> | | | | | |
| <i>C. fistula(amaltas)</i> | Deciduous | May-June | Bright yellow | Sweet scented | Seed |
| <i>C. javanica</i> (Pink cassia) | -do- | -do- | Pink | Not scented | -do- |
| <i>C. marginata</i> (Red cassia) | Evergreen | June-July | Terracotta | -do- | -do- |
| <i>Gliricidia maculata</i> | Deciduous | Feb.-Mar. | Pale pink or lilac, pea-shaped | -do- | Seed, cuttings |
| <i>Lagerstroemia indica</i> | -do- | June-July | Pink, mauve and white | -do- | Cuttings |
| <i>L. speciosa</i> (<i>L. flos-reginae</i>) | -do- | July-Aug. | Pink and mauve | -do- | Cuttings |
| <i>Nyctanthes</i> (Harsinghar) | Evergreen | Sept.-Nov. | White corolla with orange tube and centre (Night blooming) | Very fragrant | Seed, cuttings |
| <i>Plumeria</i> | | | | | |
| <i>P. acuminata</i> | Deciduous | Mar.-Oct. | Creamy white with yellow centre and pink at the out side | Lightly scented | Cuttings |
| <i>P. alba</i> | Evergreen | -do- | White | Highly scented | -do- |
| <i>P. tuberculata</i> | -do- | -do- | -do- | Lightly scented | -do- |
| <i>Punica granatum</i> | -do- | Winter | Scarlet | No scent | Seed |
| <i>Tabebuia chrysantha</i> | Deciduous | Feb.-Apr. | Canary yellow | Not scented | Seed or cuttings |



64. *Ginkgo biloba*



65. *Magnolia grandiflora*



66. *Fuchsia*



67. *Rhododendron arboreum*



68. *Hydrangea macrophylla*



69. *Kniphofia*



70. *Hydrangea macrophylla* 'Ave Maria'



71 *Hypericum patulum*,
generally a shrub —
makes a beautiful hedge
also



72. *Dichrostachys
cinerea*

reddish-yellow turning into vermilion-coloured clusters of flowers in April-June which contrast prettily with dark-green shiny wavy-edged foliage. Its tender foliage of coppery red colour is a heart-warming sight. The tree is conical like an umbrella with the foliage starting after about one-third to half of the lower stem. Kalidas, the famous Sanskrit playwright, made the tree immortal in his play 'Malvikagnimitram', where the tree does not come into bloom unless a damsel kicks it.

To this personal list, I would like to add *Ginkgo* for rich golden colour of its leaves in winter and *Mesua ferrea* for its conical elegant shape, carmine colour of new leaves and attractive creamy white fragrant flowers. *Brownea ariza*, is recommended strongly by a friend. As mentioned by him, it is an evergreen of 5-7 m height. In February-June, it bears scarlet tubular flowers nicely arranged and hanging from the drooping branches. The twigs and leaf stalks are hairy at first. The young leaves are attractive pale buff to pinkish brown. Easy to propagate by air layering. It grows well in a tropical climate with little variation in temperature, and moderate rainfall and humidity. Needs protection from midday sun at the seedling stage if the temperature is high.

One can have an exclusive preference for a tall foliage tree. If you have advantage of living in the hills, it could be a pine. It reflects the freedom and joy of the hills as it noisily sways with the wind. The pine is loved in the hills like the coconut in the South. It keeps them warm and the warmth keeps them alive. It provides wood for roof and fire for the home. Its needles provide material for mattresses. Its gum is used for resin and turpentine. Some species can be grown in the plains also. In South India, it will grow only at medium elevations and above. It is slow-growing, but looks lovely as it grows. The clusters of new leaves on top of the old ones look very pretty as the weather warms up. Similarly, a colony of young trees looking like a group of small children is a delightful sight.

SELECT LIST OF SMALL TREES FOR THE HILLS

| Name | Deciduous or evergreen | Time of flowering | Colour of flowers | Scented or not | Common method of propagation |
|--|------------------------|-------------------|--------------------|---------------------|------------------------------|
| <i>Acacia</i> | | | | | |
| <i>A. alata</i> | Evergreen | Nov.-Dec. | Bright yellow | Scented | Suckers |
| <i>A. dealbata</i> | -do- | Mar.-Apr. | Light yellow | -do- | -do- |
| <i>Bauhinia variegata</i> | Deciduous | Feb.-Mar. | Rose, purple white | Not scented | Seed |
| <i>Magnolia grandiflora</i> | -do- | Apr.-May | White | Exquisite fragrance | Air layering |
| <i>Prunus serrulata</i> (Japanese cherry) | -do- | November | Pink | Not scented | Cuttings |
| <i>Rhododendron</i> | | | | | |
| <i>R. arboreum</i> | Evergreen | Apr.-May | Crimson | -do- | Air layering |
| <i>R. campanulatum</i> | -do- | -do- | Magenta | -do- | -do- |

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Casuarina equisetifolia is a very pretty foliage tree like a cypress mainly for the coastal areas. It makes a beautiful tall hedge also in a short period of 4-5 years. Propagated from seed.

Araucaria and *Cryptomeria* and certain species of cypress are foliage trees in the hills. They grow up to be huge trees like a deodar (*Cedrus deodara*) in due course. But they are slow growing and can decorate the lawn in a small house for a number of years. A deodar stands out for its majesty and delicately pretty dark-green foliage.

SELECT LIST OF SHRUBS FOR THE PLAINS

There are many pretty shrubs for the plains. Some of the liveliest are *Acalypha* (bronze-red leaves), *Allamanda* (bright yellow), *Amaranthus tricolor* (leaves brown-red, magenta-red and cream combined), *Aralia*, *Croton*, *Cyperus* (certain species), *Duranta plumieri variegata*, *Gynura* (purplish brown velvety leaves), *Mussaenda*, *Poinsettia* as the foliage shrubs, and *Beloperone* (copper brown bracts), known as 'Shrimp flower', *Cassia artemisioides* (acacia yellow with fine fragrance), *Crossandra* (apricot-orange), *Franciscea latifolia* (change from purple to mauve to white), *Galphimia* (mustard yellow, flowering throughout the year), *Hibiscus* (many colours as white, pink, red, coral terracotta, orange, daffodil, yellow, etc.), *Ixora* (red, white, cream), *Jatropha* (magenta rosy flowering throughout the year), *Lagerstroemia indica* (mauve, pink, rose, white), *Oleander* (rose, light pink, white, red), *Pentas* (red, pink, mauve, white), *Tabernaemontana coronaria* (*chandani*) (white) as flowering shrubs.

Gardenia and *Jasminum sambac* are unrivalled for their fragrance. *Lawsonia alba* and *Murraya exotica* combine fine fragrance with beauty of foliage and suitability for a good hedge. *Murraya exotica* is excellent for training into any shape. *Cestrum nocturnum* (Queen of the night) gives most delicious fragrance at night. Most of the shrubs in the plains are evergreen. *Cassia artemisioides* and *Lagerstroemia* are some of the exceptions. *Cassia artemisioides* for me is love at first sight. It is one of the most delicate-looking small shrubs with greyish-green foliage, exquisite fragrance and tiny globular yellow flowers in February. *Franciscea latifolia*, known popularly as 'Yesterday, Today and Tomorrow', has soft lingering fragrance with mauve flowers around Holi time (March) in Shillong turning into lilac and white, all at the same time. The Japanese Quince (*Chaenomeles lagenaria*) produces glowing red flowers at the same time as *F. latifolia*. *Forsythia* (bright yellow) is the harbinger of spring. *Jacobinia* with its dark green veined foliage and carmine red flowers in flushes can be very distinctive. *Abutilon* with its coral-coloured, deep-veined flowers in semi-spherical shapes and strikingly attractive variegated leaves makes a very handsome shrub. *Serrisa foetida* produces tiny star-like white flowers throughout the season and they make a pretty contrast against its small dark-green leaves. And there is the *Luculia*, found wild in the Khasi Hills, with its soft pinkish-white fragrant flowers of delicate beauty.

My favourites would also include some others with distinct presence, viz. *Calliandra* (crimson powder-puff like flowers in February-March), *Punica granatum nana*

TREES AND SHRUBS

SELECT LIST OF SHRUBS FOR THE HILLS

| Name | Deciduous or evergreen | Time of flowering | Colour of flower | Scented or not | Common method of propagation |
|--|---|------------------------------|--|------------------------|---------------------------------|
| <i>Azalea</i> | Deciduous | Mar.-May | White, pink, mauve, coral, magenta | Not scented | Cuttings |
| <i>Rhododendron</i> | Evergreen | Feb.-May | Crimson, scarlet and white | -do- | Air layering |
| <i>Buddleia lindleyana</i> | Deciduous | June-July | Mauve and pink | -do- | Cuttings |
| <i>Camellia</i> | Evergreen | Dec.-Feb. | Pink, rose and white | -do- | -do- |
| <i>Chaenomeles lagenaria</i> | Deciduous | Feb.-Mar. | Crimson-ruby red | -do- | Root division and runners |
| <i>Dombeya spectabilis</i> | Evergreen | Dec.-Feb. | Transparent rose-pink and white | -do- | Cuttings |
| <i>Forsythia</i> | Deciduous | Feb.-Mar. | Bright yellow | -do- | -do- |
| <i>Franciscea latifolia</i> | Deciduous | Mar.-Apr. | Change from purple to mauve to white | Delicately scented | -do- |
| <i>Fuchsia</i> | Evergreen but requires hard pruning | June-Sept. | Purple sepals and rose petals are white and apricot-orange | Not scented | -do- |
| <i>Gardenia</i> | Evergreen | May-Sept. | White | Sweet scented | -do- |
| <i>Hibiscus</i> | Deciduous | Apr.-Oct. | White, blue, red | Not scented | -do- |
| <i>Hydrangea</i> <i>H. mutabilis</i> | Deciduous | June-Sept. | Pink or mauve (bronze red and others not common) | -do- | -do- |
| <i>H. paniculata</i> | Deciduous | June-Sept. | White | -do- | -do- |
| Holly (<i>Ilex</i> <i>acquistifolium</i>) | Evergreen | Bears fruits in Dec.-Feb. | Red berries (Also there is Japanese holly which bears purple black berries) | Not scented | Seed |
| <i>Lagerstroemia</i> <i>indica</i> (can be trained to remain as a shrub) | Deciduous | June-July | Pink, mauve, rose, white | Not scented | Cuttings |
| <i>Magnolia</i> <i>M. fuscata</i> | Deciduous | Apr.-May | Cream, white | Exquisite fragrance | Air layering |
| <i>M. obovata</i> | -do- | -do- | Brownish red | Not scented | -do- |

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Table (Contd.)

| Name | Deciduous or evergreen | Time of flowering | Colour of flower | Scented or not | Common method of propagation |
|---|---------------------------|---------------------------------|--|-------------------|---------------------------------|
| <i>M. soulangeana</i> | -do- | Jan.-Mar. | -do- | Fragrant | -do- |
| <i>Plumbago</i> | -do- | Apr.-June | Pale blue | Not scented | Suckers, cuttings |
| <i>Prunus</i> | -do- | Mar.-Apr. | Rose, white- pink | -do- | Cuttings, root division |
| <i>Rhododendron formosum</i> | Evergreen | Apr.-May | White | Not scented | Air layering |
| <i>Russelia juncea</i> | Evergreen | Almost through- out the year | Salmon-red | -do- | Cuttings, root division |
| <i>Solanum pseudocapsicum</i> | -do- | Summer | Yellow or cherry-red berries | -do- | Seed and root division |
| <i>Spiraea</i> | Evergreen | Early spring | White, rose | -do- | Root division |
| <i>Strelitzia reginae</i> (Bird of Paradise) | -do- | -do- | Shiny orange with blue tinge | -do- | -do- |
| <i>Tibouchina</i> | Deciduous | June-July | Royal purple flowers shed off the same day | -do- | Cuttings |

(scarlet in summer and rains), *Russelia juncea* (salmon rose in January-February), *Sophora tomentosa* (bright-yellow, pea-shaped in January-February), *Tecoma stans* (bright yellow almost throughout the year) and *Thevetia nereifolia* (yellow tubular in summer and rains).

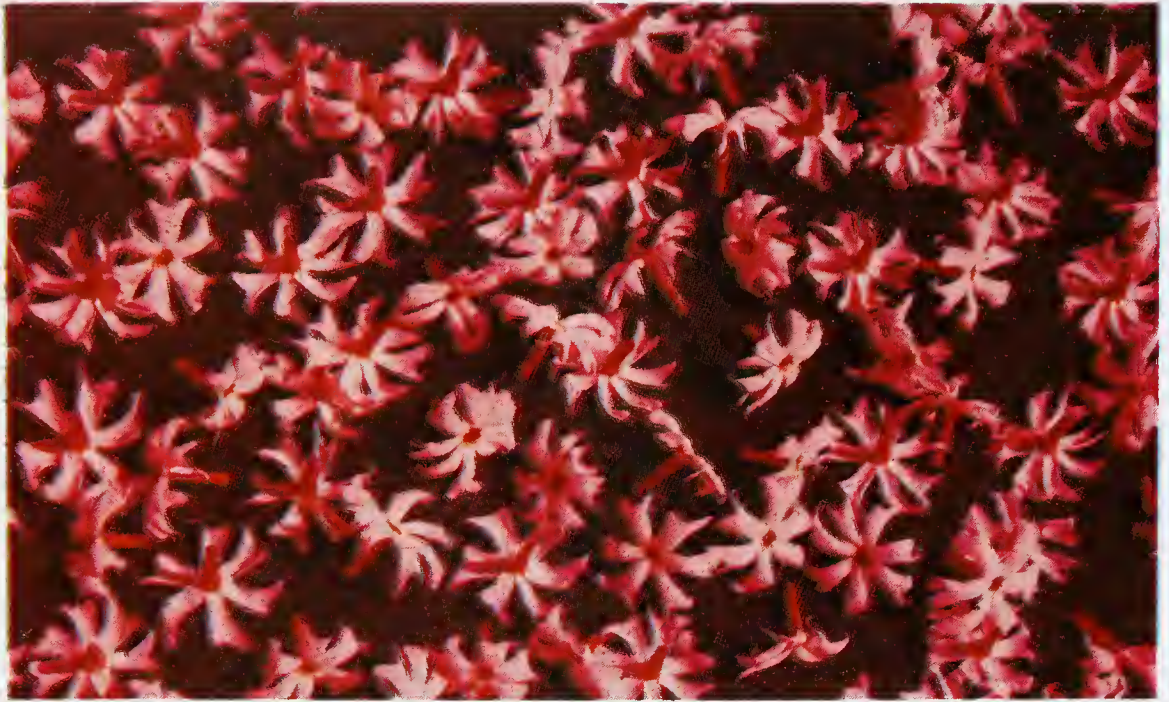
Among other favourites are *Achillea*, *Cytisus scoparius* (bright yellow flowers, in April), *Daphne odora* (white, sweet scented in summer), Gorse or ulex (yellow in April-May with grey-green spiky foliage), *Kerria japonica* (yellow, in May-June), *Solidago* and *Woodfordia floribunda* (brick-red, in March-April). A special mention may be made of the 'pitcher plant' *Nepenthes khasiana* in the Khasi and Jaintia Hills because it produces a sweet juice with which it attracts insects and digests them. The lovely foliage shrubs will include the junipers and many species of cypress and poinsettias. It is difficult to omit any as each one has its distinct presence.



73. A *Moraea iridoides* shrub



74. A *Moraea iridoides* flower



75. A carpet of flowers of *harsingar* (*Nyctanthes*)

76. Oleander, a pretty shrub of the plains





77. *Poinsettia* (*Euphorbia pulcherrima*), gladdens in winter



78. *Paphiopedilum insigne*

79. *Calanthe masuca*



80. *Cypripedium*





81. *Dendrobium densiflorum*



82. *Dendrobium densiflorum*

83. *Dendrobium fimbriatum*
var. *oculatum*, happy on a
top of tree



- 84 *Paphiopedilum fairieanum*, an
orchid reported at one time to
be lost



85. 'Stag horn fern (*Platycerium alcicorne majus*)

11

ORCHIDS, FERNS AND PALMS

ORCHIDS

ORCHIDS grow under conditions of high humidity. They can be cultivated in green-houses by artificially creating such conditions. They grow in the crevices of rocks or in moss-covered branches or pockets of branches where well-rotted humus has settled. The normal period of bloom is from March-April to November-December. Due to the fact that the roots of orchids cling to tree-bark, some believe they are parasites. But orchid-lovers object to this statement and explain with pride that the orchids derive their food from air and light and in some cases from well-rotted humus. An orchid is particular about its environment. Its delicately pretty blooms with unusual forms look exotic. It is very costly as it is comparatively rare. It is difficult to be propagated from seed. Its commercial propagation is of recent introduction. It has not yet become a common garden plant. It is a rare presentation gift and a prized possession. Its blooming in your garden is an exciting event, and is a very rewarding experience. Orchids respond favourably to those who are kind and gentle to them and anyone to whom orchids have shown such partiality cannot but miss them when separated from them. Orchids are very sensitive to their environment and immediately express their displeasure by not producing flowers for which the gardener may have anxiously waited for a full year.

The success with one orchid will take you to others and from cultivated orchids to those in their natural habitat in the forests. While driving past the countryside, your eyes will catch a breath-taking sight of a bunch of gorgeous-coloured orchids peeping out from the dark foliage of a huge tree. My first orchid was a *Cymbidium giganteum*. Its spray of about 10-12 large flowers of soft yellow and greenish brown attracted me and I was proud of possessing it. I tied it on a pine tree and it refused to grow. I wondered why – there was shade, there was moisture, but the plant was gradually fading away. I soon learnt that orchids generally dislike pine trees, and so also any tree which can be used for oil extraction. I have only recently seen *Agrostophyllum* growing on pine trees.

HOME GARDENING

A great disservice is done to the orchids by those who hang them up in the baskets, exposed to sun and wind. When collected from the forest, they are lush green and succulent with buds swelling as if with the joy of life, but soon they lose colour and vigour and eventually die. Orchids need protection from direct sunshine particularly in the afternoon. They also need protection from cold and hot winds. A sheltered place with morning sunlight only and provision for plenty of watering (in the absence of rainfall) is required. In India, orchids mainly grow in Darjeeling, Kerala, Coorg, Bangalore, Himachal Pradesh and the north east.

There are orchids which grow upon trees and have their roots exposed to air are called epiphytic. And there are others which have their roots in soil known as terrestrial or ground orchids.

Epiphytic orchids. Epiphytic orchids are grown on trees which get covered with moss, like plum, peach, apricot, oak, rhododendron or which have heavy shade, like the mango, *Ficus*, rain tree, etc. In the Kangra Valley, as you drive from Kangra to Dalhousie, you can see *Rynchostylis retusa*, the 'Foxtail orchid', growing beautifully on the roadside *Ficus* trees in April-June. As a substitute to trees, the orchids can be grown on pieces of wood. The piece of wood about 30-45 cm ($1-1\frac{1}{2}$ ft) long and about 10-15 cm (4-6 in.) diameter, should not have a very smooth surface. Its bark should be retained intact. It is better if the piece is well decayed. Alternatively, the piece may be slightly burnt in hot wood ashes. Roots take to such wood much better than the one with fresh, tender, smooth surface. In dry conditions, it is better to cover the roots with moss or gunny bag which is kept moist. In wet conditions or during the heavy rains, it is better not to cover these roots as they are likely to get suffocated and tend to rot. I have seen a blue vanda (*Vanda caerulea*) with its enchanting blue flowers with dark blue dots very happy on a log of wood which had been held vertically in a pot with charcoal pieces, bark pieces and small stones.

Ground orchids. For ground orchids, the soil mixture should be very light, simulating the natural conditions, as far as possible, of humus and charcoal. A good mixture is well-decayed leaf mould (six parts), charcoal powder or ash (one part), bark pieces (two parts), and charcoal pieces (one part). To this mixture I add one part of well-rotted cowdung manure and one part loam for *Phaius*, *Cypripedium* (*Paphiopedilum*) and also for *Calanthe*.

Cymbidiums, though epiphytic in nature, do better as ground orchids, but do not like so much soil as *Cypripedium* (*Paphiopedilum*) or *Phaius tankervilleae*. I grew them successfully by putting them on an east-facing border under the roof projection of a wall. Small pieces of charcoal and small rough stones were placed underneath. Some moss was spread on them and the roots were placed on the moss. The roots were again covered with moss and pressed with charcoal and stones. No air pockets should be left between roots and the surface to which the roots cling. *Cymbidium* grows equally well on the forks of the tree branches.

Application of liquid manure of cowdung to ground orchids, particularly to a gross

feeder like *Phaius tankervilleae* is helpful when buds are forming.

FERTILIZERS. The balanced feed of nitrogen, phosphate and potash in the ratio of 10:12:10 and a pinch each of magnesium, calcium, manganese, iron, boron and zinc has been recommended as very effective on a large number of species and hybrids. For mature and flowering plants, 2 tablespoonfuls of the above fertilizers mixed in 10 litres of water is sprayed once a week during the growth period while a solution of half this strength is used on seedlings. Leaves and rooting media should be thoroughly sprayed with the fertilizers' solution. A number of prepared fertilizers are available in the orchid-growing countries abroad, but have yet to be introduced in India.

PROPAGATION. Propagation by amateurs is generally by root division as in *Cattleya*, *Cypripedium* (*Paphiopedilum*) or *Dendrobium*; division of pseudo-bulbs as in *Cymbidium* or *Phaius*; by offsets as in *Dendrobium*; and by cuttings or air-layering as in *Vanda* or *Rynchostylis*. In *Arachnis*, *Renanthera* and to a lesser degree in *Vanda* propagation is done by cuttings. The stem of the plants which produce adventitious roots is cut in sections of 3 to 4 nodes, placed in a cool and dry place for healing of the wound and allowed to root in moist sand or damp moss. I was very successful with aerial-rooted *Dendrobium* cuttings and also with the bamboo orchid cuttings growing naturally from the older stems, by putting them straight after the cut into a light mixture of leaf mould (6 parts) and ash (1 part) and covered with moss kept damp. A very sophisticated technology of multiplication or hybridization of orchids through seed or meristem culture has been developed and is the main method of commercial propagation. It need not be attempted unless expertise is built.

The best time for propagation is February-March when the orchids show signs of growth after rest during the winter. It may also be done immediately after flowering when they send up new shoots. For most of the orchids, the rest period is from November-December to February-March.

A very important principle in potting ground orchids is that their pseudo-bulbs as of *Cymbidium* or *Phaius tankervilleae* should be just above the ground. If they are buried in the soil, the plant may dry or may not flower. Similarly, in the case of *Cypripedium* (*Paphiopedilum*) the roots should be just below the surface and the stem should be fully out of the soil.

IDENTIFICATION. A layman might like to know how to identify an orchid from another flower. Taking advantage of the ignorance of many, some try to pass off any unusual-looking flower as an orchid. An orchid has three sepals and three petals. One of the petals has a very striking and unusual form like a lady's slipper in *Cypripedium* (*Paphiopedilum*) also known as 'Lady's Slipper Orchid' or like a spider in *Oncidium* also known as 'Spider Orchid' or with a bright dot looking like an eye in *Dendrobium fimbriatum* var. *oculatum*.

Containers and arrangements. The orchids can be beautifully grown in different types of containers of bamboo, wood or earthenware. An arrangement of orchids was made on a plum tree which did not give fruit and was cut from the base and planted in the

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ground. The orchids were tied on it at suitable places and were also hung from it from the tips of the branches at different levels. It was placed against an east wall, where it got morning sunshine and was protected from wind. It presented a beautiful sight. I am recently also growing them in baskets made of thin branches nailed together in a square arrangement and lined with coconut fibre.

The keeping quality of orchids as a cut-flower is unrivalled. The lower-spray by itself is a nature's flower arrangement. It is also excellent for flower arrangement in combination with other plant material, or for hair decoration. In fact *Rynchostylis retusa* looks as if woven as a hair band. It is popularly known also as a hair-garland.

Mist chambers. It is interesting to witness the development of mist chambers in dry and hot conditions of northern India for growing orchids. A greenhouse which is seldom seen in India may become a popular feature of home gardening in the next decade.

Pests and diseases. Their common pests are aphids, bugs, scales and thrips. Orchids are also prone to leaf spots. The spots may be formed on the leaf petiole, psuedo-bulbs and other aerial parts.

SELECT ORCHIDS

Some of the orchids of India which grow easily may be grouped as follows as primarily ground or epiphytic orchids suitable for the tropical and temperate regions. Different species of some of them may suit different regions or conditions of growth, e.g. *Bulbophyllum*, one of the largest genera, grows in tropical, sub-tropical and temperate regions. Though chiefly epiphytic in habit, it can be grown in the ground also. Similarly, *Vanda* is primarily suitable for warmer regions. But its species *V. caerulea* grows beautifully in the Khasi and Jaintia Hills 1,500 m (5,000 ft). In nature, *Cymbidium* grows on trees, but in cultivation it does better on ground as mentioned earlier.

| Ground | Epiphytic | Tropical | Temperate |
|---------------------------------|----------------------|---------------------|---|
| <i>Arundina</i> (Bamboo orchid) | <i>Aerides</i> | <i>Arundina</i> | <i>Aerides</i> |
| <i>Calanthe</i> | <i>Bulbophyllum</i> | <i>Bulbophyllum</i> | <i>Bulbophyllum</i> |
| <i>Cymbidium</i> | <i>Cattleya</i> | <i>Cattleya</i> | <i>Calanthe</i> |
| <i>Cypripedium</i> | | | |
| (<i>Paphiopedilum</i>) | <i>Coelogyne</i> | <i>Cymbidium</i> | <i>Coelogyne</i> |
| <i>Phaius</i> | <i>Cymbidium</i> | <i>Dendrobium</i> | <i>Cymbidium</i> |
| <i>Pleione</i> | <i>Dendrobium</i> | <i>Oncidium</i> | <i>Dendrobium</i> |
| | <i>Odontoglossum</i> | <i>Rynchostylis</i> | |
| | <i>Oncidium</i> | <i>Vanda</i> | <i>Cypripedium</i> (<i>Paphiopedilum</i>) |
| | <i>Rynchostylis</i> | | <i>Phaius</i> |
| | <i>Thunia</i> | | <i>Pleione</i> |
| | <i>Vanda</i> | | <i>Pholidota</i> |
| | | | <i>Odontoglossum</i> |
| | | | <i>Renanthera</i> |
| | | | <i>Saccolobium</i> |
| | | | <i>Thunia</i> |
| | | | <i>Vanda</i> |



86. *Adiantum subcordatum*

87. *Dryopteris extensa*





88. *Nephrolepis exaltata*

89. *Pityrogramma chrysophylla* — a 'Gold Fern'



90. *Pteris cretica* 'cris-
tata'



91. *Polypodium poly-
carpon*



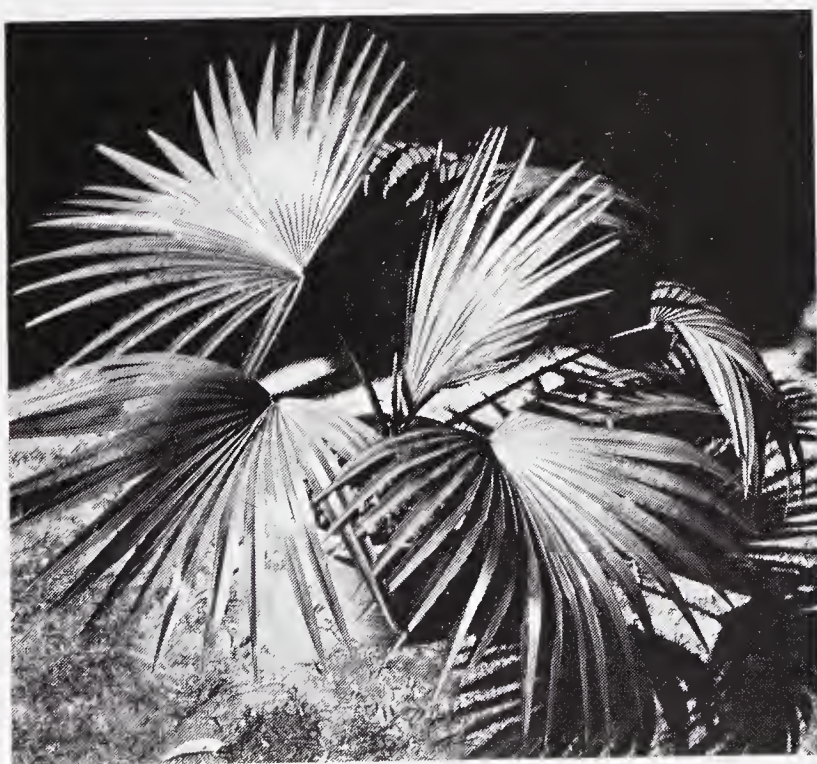
92. A cycad

93. *Caryota mitis* (Fishtail palm)





94. *Raphis flabelliformis*



95. *Thrinax excelsa*

Cypripedium fairieanum (*Paphiopedilum fairieanum*), a lost orchid, has been rediscovered in Arunachal Pradesh. *Dendrobium pierardil* is a magnificent sight at the time of Holi in the month of March with its over 1-m-long (3.3 ft long) pseudo-bulbs full of soft mauve-lemon drooping flowers. *Vanda teres*, known as 'pencil orchid', suddenly comes to notice on the tree branches when it comes to bloom.

FERNS

Ferns comprise a very large family of many genera and species. They are excellent house plants. The variety of shape, size and colour of foliage can merit a separate plant-house called the 'fernery'.

There are ferns suitable for tropical, sub-tropical and temperate climates. They are not so fussy about climate as about position. The position should be moist, well drained and shady. They hate direct exposure to sunshine and love lime and mortar and leaf mould. Their roots cling to mortar pieces and thrive well. They seldom revive satisfactorily once subjected to severe drought conditions. They are reluctant to accept a change of site. Therefore, it is better to carry some soil from the original place.

There are very fragile looking ferns like *Adiantum* (Maiden hair fern) and broad-leaved ones like *Asplenium nidus*; very tall ones like tree ferns growing wild in the hills; there are climbing ferns like *Lygodium*; there are fussy ones difficult to grow like *Platyserium* (Stag's horn fern); and there are very sturdy ones considered old-fashioned like *Nephrolepis* which grow from the sea-level to beyond 1,500 m (5,000 ft) above sea-level. *Nephrolepis* is a good friend who does not part company even under conditions of extreme drought and heat to very cold and moist. Floating aquatic ferns are also reported like *Azolla*. There are fragrant ones found in the Khasi and Jaintia Hills like *Lindsaea odorata* Roxb. One of the strikingly attractive ferns found on the big trees in the Khasi Hills, with erect and tall leather-stiff fronds with prominent veins, spores in the form of hyphens and thick brown rhizomes covered with brown hair-like scales, is *Drynaria propinqua*. I hesitatingly took a cutting of the rhizome with a frond and it took roots and multiplied well. *Osmunda regalis* has remarkable rust colour of its new fronds which open slowly retaining the unusual colour for 2-3 weeks.

Selaginellas. Selaginellas, called 'creeping moss', grow under conditions of high humidity and existence of leaf mould similar to those of ferns and can be grown together. They are sometimes confused with ferns because of resemblance of foliage. The distinguishing feature is that the stem of *Selaginella* bears four rows of scale-like leaves and the stems have creeping habit. Their bright green foliage looks attractive in the rains.

Propagation. Ferns and selaginellas can be propagated by division of roots during the rains in the plains and in spring in the hills. Ferns can also be multiplied by spores. But this would be difficult for an amateur.

Soil mixture. An excellent soil mixture may be one part each of loam, leaf mould,

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sand and broken pieces of charcoal and mortar pieces about 1.5-2.5 cm (1/2-1 in.) size and half part farmyard manure, with a handful each of lime and ash per plant.

SELECT FERNS

Adiantum. *Adiantum* is one of the most popular ferns and is known as the 'Maiden-hair' fern, perhaps because of its very dainty and black hair-like stems. There is general resemblance in the species. The tiny leaves on both sides of the stem are roundish and the plants have a delicate appearance. Their greatest quality is ease of cultivation. They grow in the nooks and corners of walls and along the cement drains, getting plenty of moisture, partial sunshine and lime mortar. The variety *A. caudatum* has comparatively 'giant' leaves. One of the prettiest species is *A. cuneatum* with its number of varieties. It makes a lovely drooping delicate mass of foliage. *A. decorum* and *A. microphyllum* are also delicate looking. *A. tenerum* var. *farleyense* forms a spectacular pot plant with gracefully drooping fronds and is one of the excellent species. Its fronds when young are rose-tinted. It needs good attention.

Anemia. A genus of small ferns. The beauty of the plant is in its ash-coloured leaves, hence its popular name, 'Ash fern'. Because of the beauty of the plant, it is also known as 'Flower fern'.

Asplenium. A genus of varied plants from the handsome large-leaved *A. nidus* to the very delicate *A. myriophyllum* or *A. bulbiferum*. Most of the species thrive in the hills. *A. nidus*, popularly known as 'Bird's nest fern', has broad shining pale-green leaves as long as a metre with a dark-brown central vein, more prominent on the under surface. It is unusually showy. The fronds are very long, of spatula shape. The centre of the plant is broad enough to house a bird's nest. *A. palmatum* has broad palmate leaves which get affected by the dry and hot weather of North India. Does better in the hills. *A. bulbiferum* does well in the plains also. It is a 'mother fern' which has small plants on the fronds.

Cyathea. Popularly known as 'Tree fern' because of the tree-like trunk it develops over a number of years. It is extremely slow growing and is an excellent host for the orchids. *C. gigantea* has been declared as a threatened plant.

Davallia. Some of the handsomest ferns belong to this genus. They have white woolly creeping stems which cling on trees and logs of wood. Can be grown in pots and baskets also. The creeping stem and erect fronds lend interesting personality to the plant. It looks extremely pretty growing on a moss-covered log. The emergence of tender fronds with the advent of spring on a leafless branch is a beautiful sight. It is known as the 'Hare's-foot fern' or 'Squirrel's-foot fern' because of the unusual foot-like shape of the sprawling stem. One of the loveliest species is *D. bullata* which has delicate foliage and strong creeping stems.

Drynaria. A genus with large ferns, growing from the high hills to the plains. *D. quercifolia* has finger-like creeping rhizomatous roots growing high up along the trees. The leaves die in winter and the new ones, russet brownish-green coloured look very

attractive. *D. propinqua* is discussed earlier.

Lygodium. A genus of climbing ferns with thread like stems. *L. flexuosum* and *L. japonicum* are common species suited to humid climate. The pinnae arise in pairs from the end of short spurs. It is grown on tree pillars under shade. It is very common in the Khasi Hills and is found in the ground.

Nephrolepis. One of the sturdiest ferns thrives well from upper Himalayan ranges to the plains. Very easy to grow. There are varieties with smooth, serrated or crinkled leaves. By its symmetrical semi-erect habit it makes a neat little bushy plant. Unrivalled is *N. exaltata* with its numerous varieties. The most common is the rather plain looking *N. acuminata*.

Osmunda. Grows better in the hills. *O. regalis* known as the 'Royal fern' is one of the handsomest species.

Platycerium. A genus of unusually attractive ferns known as the 'Stag horn fern' because of similarity of the indented fronds with the horns of a stag. They are epiphytic and grow to large size in their natural habitats. At the base of the plant grows a broad round leaf which covers the roots and keeps them cool and also retains moisture. Can be grown on a log of wood with roots covered with moss or in a pot in a mixture of charcoal pieces and leaf mould. The most common species is *P. alcicorne*.

Polypodium. Polypody, as the plant is commonly called, is an evergreen fern, easy to grow. *P. vulgare* is a popular species with 15-30 cm long fronds growing singly from a creeping rhizome. *P. aureum* is another beautiful species, fronds deeply cut, bluish-green in colour.

Pteris. A common fern in the plains, includes some pretty variegated fronds as in *P. ensiformis*. There are finely serrated leaves as in *P. dentata* or smooth ones as in *P. cretica*. The variegation may be in the central margin or with shading from the centre to the edge of the leaf along the veins.

PALMS

Palms are mostly tropical plants and thrive well in light sandy soil and warm, humid places. There are species which grow in the sun as well as in the semi-shade. The palms are suitable for verandahs, staircases, for avenues or shaded portions of the garden. They make excellent pot plants. There are a few species which grow in the hills also. The palms are subject to very few diseases and pests. They need regular and liberal supply of water. Those which suffer from extreme neglect of water seldom recover.

Propagation and cultivation. Palms can be propagated from seed, root division or suckers. Propagation from seed is rather slow. Very few palms produce suckers and this includes *Caryota*, *Chamerops* and *Rhapis*. Palms seem to prefer to be pot-bound and thrive in undersized pots. Slow-growing species can remain in the same pot for a number of years. In repotting, the thick and fleshy roots should not be damaged. One part leaf mould, one part well-rotted cowdung manure, 1/4 part sand and 2 parts garden soil is a

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good compost for the palms. An addition of a tablespoonful of bonemeal for every 25 cm (10 in.) pot is useful. Application of a small dose of ammonium sulphate brightens the colour of the leaves. About 1/2 tablespoonful for each plant may be used twice at monthly intervals in the rainy season. When in active growth liquid manure of cowdung applied at fortnightly intervals is helpful.

Most species have an erect, tall, cylindrical or columnar stem called the caudex. The caudex is smooth in some as in *Areca* palms or is marked by depressions left by leaves as in *Phoenix* or *Washingtonia*.

Ornamental value. Palms are of great ornamental value as foliage plants. Generally the flowers are not showy. Let such a generality not make me forget the breath-taking sight of divine pearl-cream beauty and fragrance of the inflorescence of the arecanut and coconut palms when it emerges out of its covering sheath. The plants seldom bear an inflorescence in pots.

Fan-leaved and feather-leaved palms. Palms are generally grouped under two heads – fan-leaved and feather-leaved. In the former, on the petiole is a large leaf blade which gets expanded with stiff veins and deeply serrated margins. In the latter, leaflets are arranged on both sides of midribs like a feather. The plant popularly known as the ‘Travellers palm’ (*Ravenala madagascariensis*) is, in fact, not a palm but belongs to the same family as the banana.

CYCADS

This is a group of beautiful short plants superficially resembling palm. Their cultivation is also similar to that of the palms. They are excellent house plants and are extremely slow growing. The trunk is very short, stout and rough with leaf scars. The height is 3-5 m (10-17 ft). The leaves are long, pinnate with narrow leaflets. They are pale green when young and become dark green and shiny on maturity. The leaves are commonly used for floral arrangement as they can be easily moulded into circular or semi-circular shapes and have excellent keeping quality. The cycads form beautiful crowns at the top. Propagation is easy from the suckers. They need partial shade, though in Kerala *Cycas circinalis* grows in the open sun. Some of the common species are *C. circinalis*, *C. media* and *C. revoluta*. The seed of *C. revoluta* is used as sago; hence it is sometimes known as the ‘Sago palm’.

A select list of palms divided into these two categories is given below.

SELECT LIST OF ORNAMENTAL PALMS

A. Feather-leaved palms

Caryota. Height 7 m (24 ft). These are popularly known as ‘Fishtail palms’ because the shape of the leaves is similar to that of the tail of a fish. The leaves are finely cut at the

end. These palms also give toddy. Suitable as avenue trees. Flowering is common and the drooping inflorescence is handsome. The common species are *C. mitis* which produces suckers and *C. urens* which is a suckerless.

Chrysalidocarpus (Areca) lutescens. Height 6-8 m (20-25 ft). One of the most graceful of the palms with tall, slender and yellow-green, very smooth and cylindrical stalks which forms a beautiful clump with feathery inarching (dark green) leaves. It is popularly known as 'Butterfly palm'. Its fruit is violet-black. Propagation is by suckers or seed. It makes a beautiful pot plant also.

Hyophorbe versaffeltii. Height 7-10 m (23-33 ft). The trunk is swollen about half the length like a bottle. Leaves are long and yellow veined and are inarching at the top.

Kentia (Howea) belmoreana. Height 3.5-5 m (10-16 ft). A very graceful palm with smooth stem and inarching leaves. Is very suitable for pots.

Oreodoxa regia. Commonly known as 'Royal palm' or 'Bottle palm', it has very attractive long bottle shape. Thrives well in Assam, West Bengal, Dehra Dun and Bombay. Makes a beautiful avenue tree as in the Circuit House, Dehra Dun.

Phoenix. A truly feathery palm with very narrow leaflets. The leaves are dark and shining and inarching. To this genus also belongs the date palm. Its fruit in long drooping racemes looks pretty and is used for floral arrangement. Its species *P. roebelenii* is very attractive with a height of only 60-90 cm (2-3 ft). Another species *P. rupicola* with a height of 5-7 m (16-23 ft) is also very attractive.

B. Fan-leaved palms

Corypha umbraculifera. Height 20-24 m (65-76 ft). Slow-growing palm, popularly known as the 'Talipot palm'. Its broad leaves 2-3 m (7-10 ft) across are used as umbrellas when dry. They are also used for thatching.

Chamaerops humilis. Height 2-3.5 m (7-12 ft). It is the only palm which is native to Europe and is therefore popularly known as 'European fan palm'. It produces a number of suckers which develop into offshoots and the clump thus made is very attractive and looks informal. Leaves are grey-green, split into narrow segments nearly to the base.

Lantania commersonii. Height 2-2.5 m (6-8 ft). A truly colourful palm. It is slender with leaves deeply cut and the red-veined segments are margined with chocolate red bands and fine tooth-like spines. Stalk is long, smooth and dark red.

Licuala grandis. Height 2-2.5 m (6-8 ft). One of the prettiest palms. It has slender stalk and leaves at the end of the stalk are beautifully arranged. The leaves are orbicular, somewhat wavy with a cleft margin. They look as if they have been trimmed at the edges.

Livistona chinensis. Height 2-2.5 m (6-8 ft). A graceful plant with many leaves cut into linear segments. Segments are deeply forked with threads between them. Lower part of the stalk is almost covered with the crown of the spines.

Livistona rotundifolia. Height 13-15 m (43-50 ft). One of the most common ones. Its almost round shape and bright green leaves as if painted, is striking. Its leaves are deeply cut with slender points. It has good growth in Shillong and the stalks of the leaves

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shed off by it provided excellent flower-arrangement material. *L. australis* and *L. mauritiana* are also grown.

Pritchardia pacifica. Height 6-8 m (20-25 ft). It is a tall slender palm like arecanut. Leaves are densely covered with a whitish brown substance when young.

Rhaphis humilis. Height 1.2-2 m (4-7 ft). A slender dwarf graceful palm; it produces a large number of suckers and develops into a bushy clump. Leaves are very deeply cut — almost fully, giving an appearance of separate leaves. There is another common species *R. excelsa*.

Stevensonia grandiflora. Height 12-15 m (40-50 ft). A very beautiful palm. The leaves when young are of chocolate colour. The stalks are also of the same colour. Difficult to grow.

Thrinax argentea. Height 8 m (25 ft). The large leaves are silver grey beneath and long petioles look attractive.

Thrinax excelsa. Height 5-6 m (16-20 ft). It has leaves pale green above and glaucous beneath with segments cut up to two-thirds of the leaf.

Washingtonia filifera. Height 10-15 m (32-50 ft). It has thick erect grayish trunk. Dry leaves remain on the stem for a long time. The large leaves are circular and deeply cut into many segments. At the margins of the segments there are numerous hair-like fibres.

12

CACTI AND OTHER SUCCULENTS

A succulent is a plant which has thick leaves or stems which can store water for the plant above the soil surface. It need not be confused with a tuber or a bulb which stores water and food material and nourishes the plant below the soil surface. Broadly speaking, a cactus is a succulent with thorns or areoles. The distinction, however, between a cactus and the other succulents is not so absolute and there are some cacti without thorns.

Cacti have gained popularity due to their exciting shapes, heavenly blooms and ease of cultivation. They can thrive under most indifferent conditions. Plants in the *Cereus* group, e.g. *Cereus*, *Carnegiea* or *Cephalocereus*, almost grow like large trees in their natural habitat, while *Hylocereus* or *Selenicereus* are climbers and attain unimaginable heights. *Opuntias* develop into large bushes.

One of the succulents of breath-taking beauty is an *Epiphyllum*, popularly called as the 'Star of Bethelhem'. It blooms at night around 10 P.M. and starts fading away from 2 A.M. Its soft creamy colour with a touch of light pink as if blushing, and numerous yellow-tipped filaments, a striking anther and sweet fragrance, transport one to a fairy land. There are other day-blooming ones, white, red, vermilion, etc., but none to beat this night-blooming one. *Zygocactus* with its numerous translucent magenta-red drooping flowers during Christmas is a heart-warming sight and is, therefore, popularly known as 'Christmas Cactus' or 'Thanks-giving Cactus'. Due to its exotic-looking unusual shape, it is also known as 'Orchid Cactus'. *Rhipsalidopsis* (*Schlumbergera*), in bloom around Easter, known as 'Easter Cactus', is popular because of its attractive drooping stems with terminal star-like flowers in crimson or vermilion and the ease of cultivation.

Such cacti as are seen under natural conditons growing on the trees are known as epiphytic cacti. Some of the *Cereus* group which throw up aerial roots, *Phyllocactus*, *Epiphyllum* and similar ones, belong to this group. They are often found growing on nothing but rotten leaves in the forks of the trees.

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Cristate. Sometimes a cactus makes an unusual growth on the side or top. Its shape and design is interesting. It is not considered as a disease as it does not result in loss of health or vigour of the plant. It is unique and unusual and it cannot be reproduced. It is priced very high. The cause of such a physiological condition is due to a disturbance in the growing point.

Soil and manure. Cacti and other succulents require light and porous soil in which water drains quickly. Generally the other succulents require richer soil than the cacti. One part loam, half part coarse sand, half part wood ash or charcoal powder and one part well-decayed leaf mould is a good soil mixture. For the succulents which are gross feeders, like *Epiphyllum* and similar ones like *Phyllocactus*, *Rhipsalis*, *Bryophyllum* or *Zygocactus*, to this mixture may be added a half part well-decayed organic manure. If organic manure or leaf mould is not well-decayed it may cause rotting of the plant. Rotting is faster in cacti than in other plants. If sand is not coarse, it may not provide the porous character of soil which is desired. For epiphytic cacti, liquid manure of fresh cowdung gives richness of colour to the bloom and vigour to the plant.

Propagation. For commercial purposes, most of the cacti are multiplied from seeds. The slow-growing seedlings require several years to develop into specimen plants.

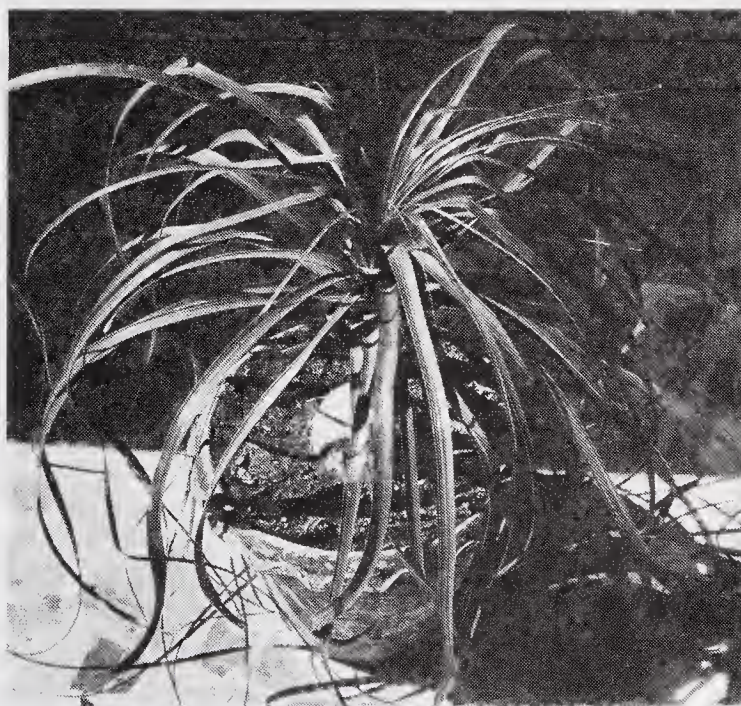
Vegetative propagation of succulents is generally from cuttings or division. Succulents produce 'babies' at their base, on the sides or at the top. They can be detached and treated as a cutting. *Mammillaria* or *Echinocactus* are examples of this type. Some cacti grow straight in a cylindrical form. A year's growth is marked by a little ring-like depression on the growth. The growth is narrowest at the junction of two years. A cutting may be taken at this point. Cerei and opuntias are examples of this group. There are some others also which can be grown from the stem cuttings, like *Zygocactus*, *Epiphyllum*, *Rhipsalidopsis* and *Phyllocactus*. Cacti like *Bryophyllum*, *Sedum* and *Kalanchoe* can be grown from leaf cuttings in addition to stem cuttings. Cacti like *Sempervivum* and *Echiveria* may be grown from leaf cuttings or suckers. Cuttings of cacti and some succulents like *Euphorbia* must be kept in a dry shady place for some time to allow them to form a callus before planting them for rooting. Narrow or small cuttings will require less period. Broad or thorny cuttings will require more period. Similarly, more period is required in cold and wet season than when it is dry and hot. If cuttings are kept too long also, they may shrivel up. For thorny globular cuttings the period may be 3-7 days. Leaf cuttings may be planted after one or two days.

Cuttings may be placed in a mixture of one part sand and one part leaf mould in dry season and 2-3 parts sand and one part leaf mould in wet season. The mixture should be kept moist till the cuttings root but over-watering will cause rot. Too rich a mixture is also likely to cause rot. Sand only is a very safe medium but needs more attention as there is danger of its drying up.

Grafting. Grafting is gaining in popularity as one of the means of vegetative propagation of cacti. In this process, one variety is superimposed on another called the root-stock. Besides the usual advantage of grafting, i.e. the vigour of the root-stock and



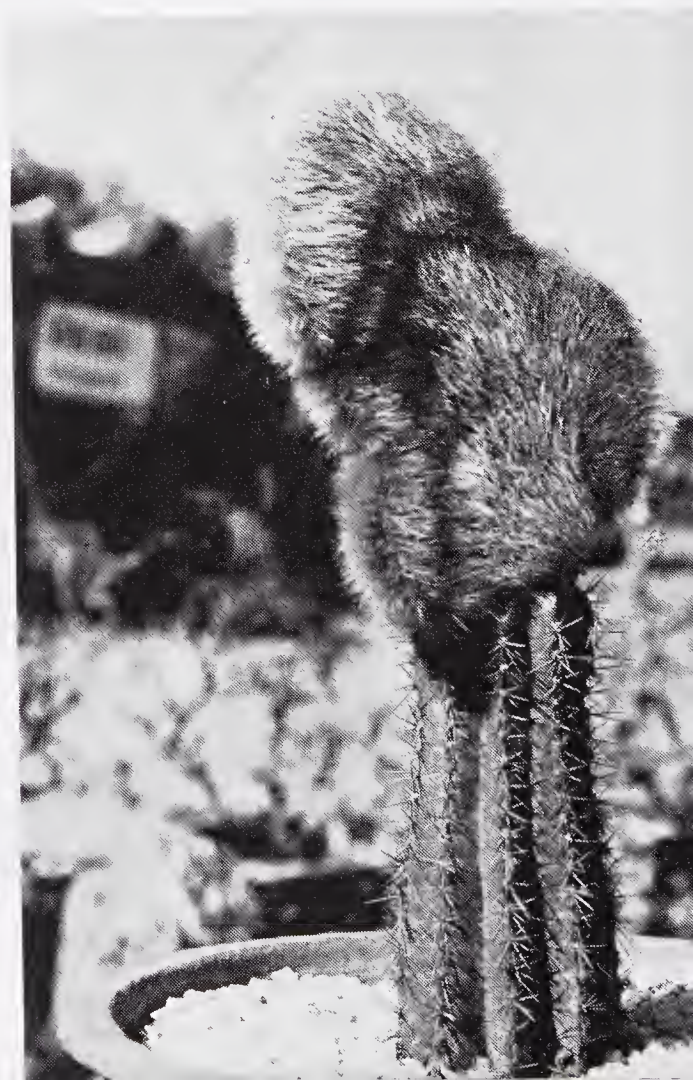
96. An *Astrophytum*, known as 'Star cactus'



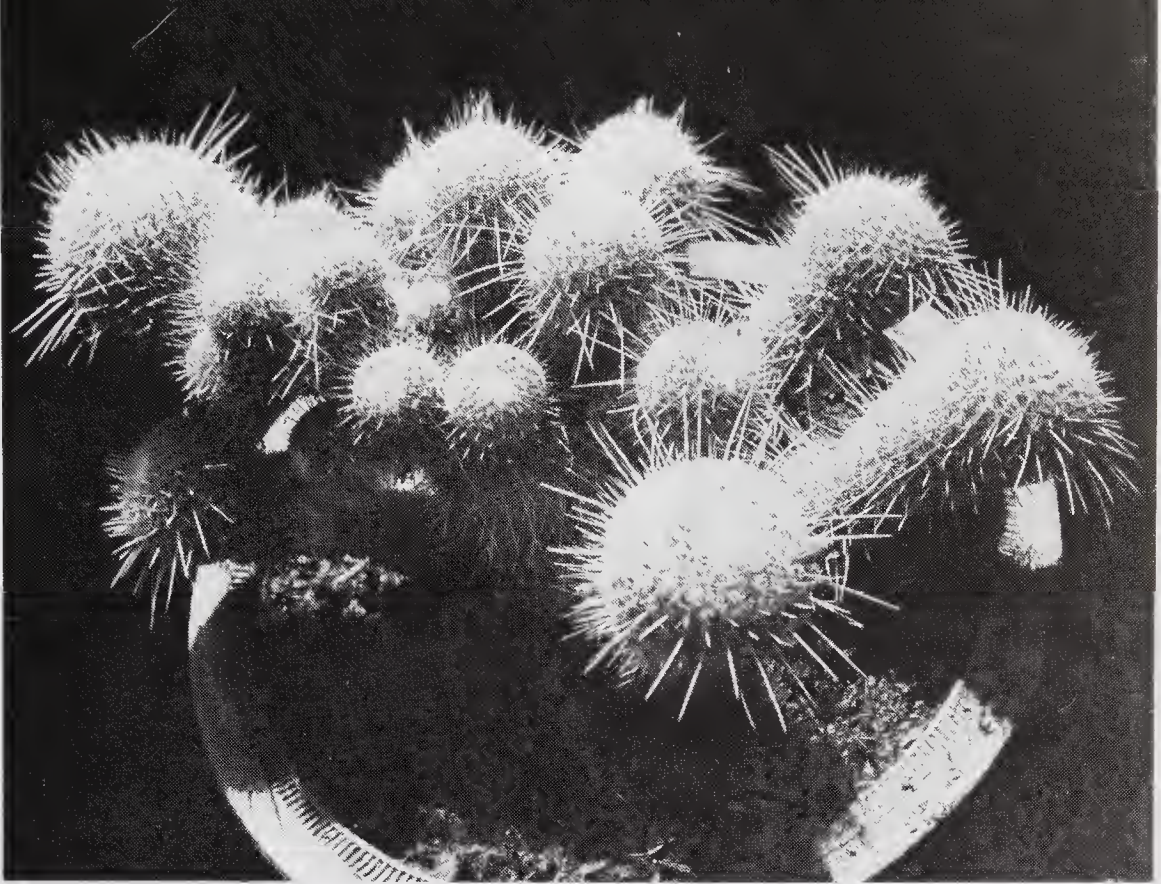
97. *Beaucarnea (Nolina)*
recurvata



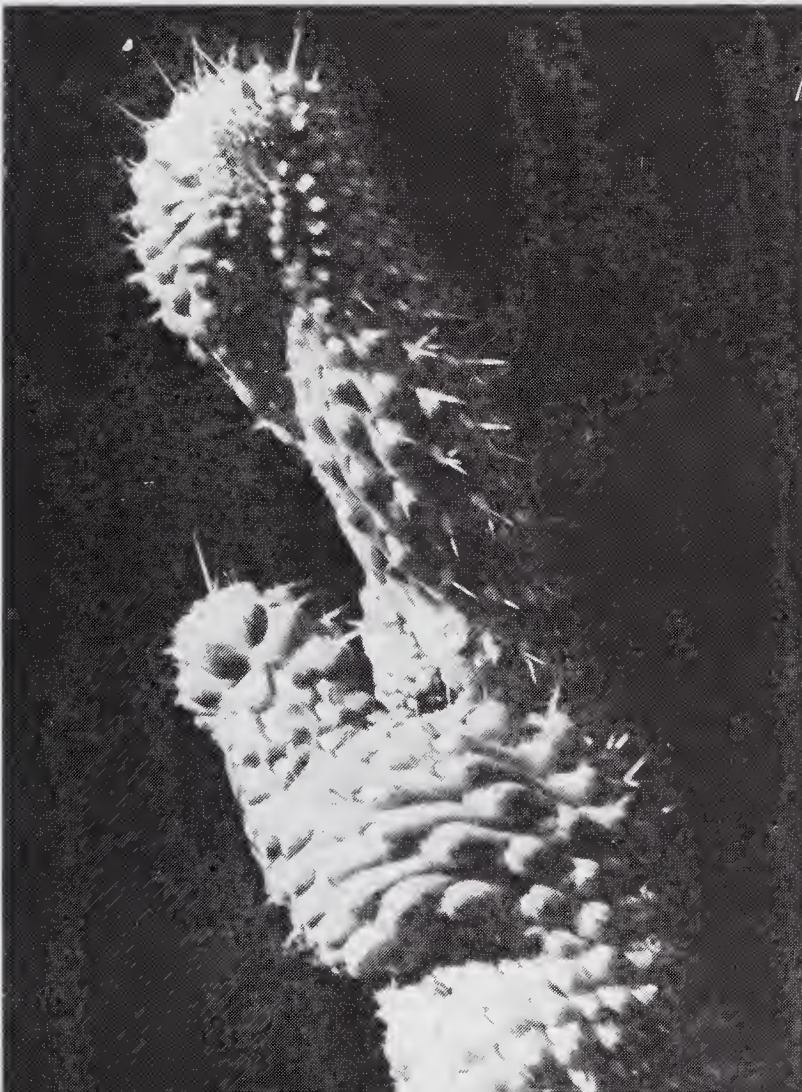
98. *Huernia penzigii*



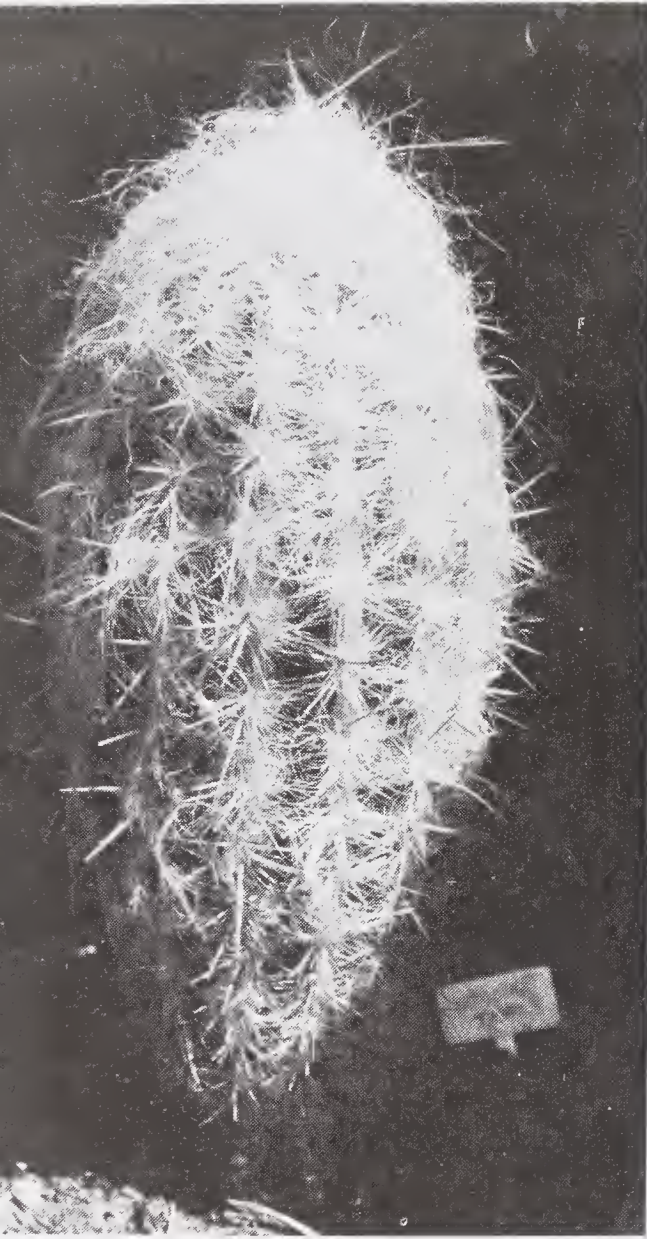
99. *Cleistocactus straussii cristata*
grafted on *Cephalocereus*
smithianus



100. *Mammillaria parkinsonii*



101. *Opuntia mammillata*
cristata



103. *Yucca filamentosa*, on way to
Chamba, Himachal Pradesh





104. *Echinocactus grusonii*

105. *Kalanchoe blossfeldiana*

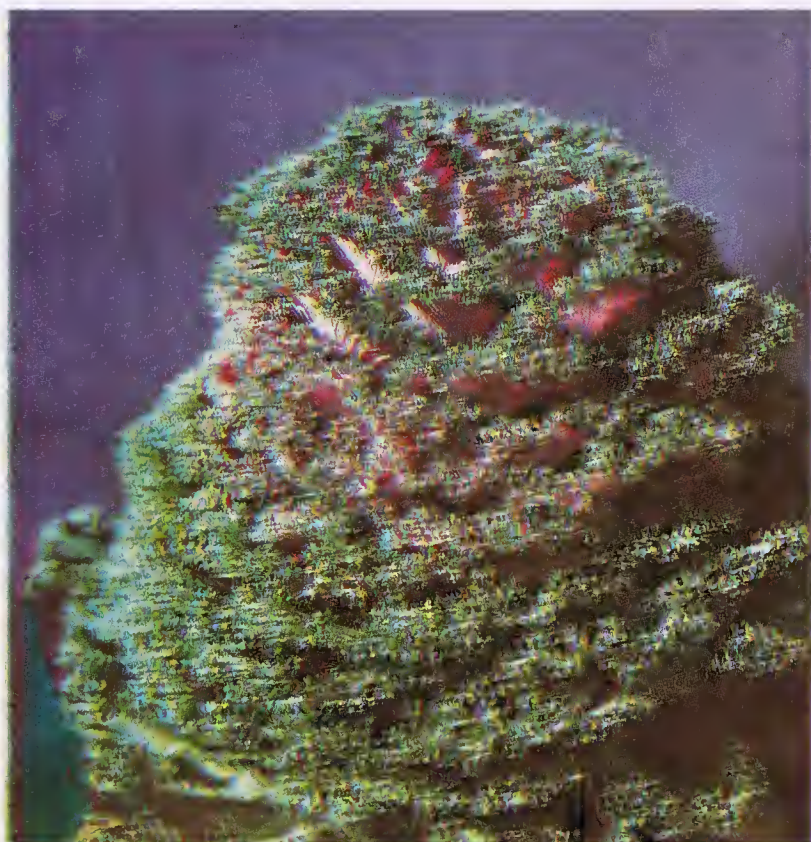


106. *Echinocactus*





107. A *Pelargonium* — a shrub with universal appeal



108. Kale, a vegetable and pretty house plant

CACTI AND OTHER SUCCULENTS

the quality of the scion, grafting is useful in saving a plant which may otherwise die due to root rot. It is helpful also in growing cristate and other cacti which are difficult to grow on their own roots. Cacti may be grafted at any stage, but better results have been reported when plants grafted are of 1-2 years age. Opuntias and the cerei group of cacti have proved a good choice for use as root-stocks.

In grafting, the vascular tissues of the scion are superimposed on the vascular tissues of the stock after making a sharp razor cut. They are kept in position by covering with wire and kept down with a weight. Wire and weight can be removed in 10-14 days.

Watering. Succulents by virtue of their tissue formation may be able to go without water for a long time. But it is essential to give thorough watering to them from time to time. As in the case of other plants, they need less water during their rest period. Epiphytic cacti need more water than the thorny ones. Overwatering is more dangerous in the succulents group than in the others. Plants are more prone to rotting. If they do not rot, they produce too much growth of leaf or stem but no flowers.

Stones around succulents. Some gardeners believe that addition of a layer of coarse sand, broken bricks or gravel 1-2 cm (1/2-1 in.) deep on the surface of the soil in a pot of succulents is advantageous as it provides good drainage around the neck of the plant, and also serves as a mulch in retaining moisture. This is not a good practice in places with heavy rains or cold climate. The stones will cause retention of moisture not near the roots but near the collar and the plant may develop collar rot. Even in dry places, this may only be for cosmetic effect.

Pests and diseases. Succulents do not attract many diseases. Collar rot, damping off, mealy bugs, scale insects and red spiders are the chief troubles. Green fly and blue fly may also cause occasional trouble. Collar rot is caused by excessive humidity or watering. Cut off the plant a little above the portion from where it has rotten and re-pot it as for a fresh cutting.

POTS, POT CULTURE AND HOUSE PLANTS

POT culture needs separate consideration because of its special features, certain limitations and specific requirements which are not applicable to ground culture.

Popularity of pot culture. Pot culture is gaining in popularity. Its greatest advantage is mobility and cultivation under regulated temperature and humidity conditions. It enables the gardener to cater to the special requirements of certain plants. The pots are helpful in creating the desired floral effect inside the house or outside in the garden. When shifted to the living rooms the pots bring the garden inside the house. A bank of pots can be arranged in the garden for a beautiful display. They can be placed in rocky or poor soil conditions where direct cultivation in the soil is difficult. The pots can supplement the total land available for cultivation. They are the chief, if not the only, medium of gardening for those living in upper storeys. They can also be used to dress an ugly or lonely corner in or around the house. A big pot with a trailing or climbing plant would be an ideal choice for pillars of a water tank, whose sides all around are *pucca*.

It has been observed by the scientists that the 'Spider plant' (*Chlorophytum*) is one of the most effective cleaners of indoor pollutants. It also keeps well for long time and in fact can grow indoors. Could be introduced more widely. *Syngonium* and golden *Pothos* (Money plant) also are good air cleaners.

Pot arrangements. I once saw *Asparagus plumosus* planted in three pots and allowed to climb on a bamboo trellis effectively covering an ugly drain.

Nothing could grow directly in the ground there as it was cement-plastered. Along the wall a wooden stand in three tiers on which pots were placed on either side provided an attractive cover to the barren walls.

Pots can be imaginatively placed on steps and staircases, balconies and the projections of the roof. If placed on the projections of the roof they should be properly fastened otherwise rain or wind may cause them to fall which may not only destroy the

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plant but also hurt a passer-by. Tall plants on the roof also need to be fastened.

Selection of pots. The selection of the pots is an important consideration in pot culture. The pots must be of porous texture so that the plant roots can have free circulation of air. Non-porous materials such as plastic, asbestos or fibre glass may look attractive but are not suitable. The best material is non-glazed earthenware. This is porous in character, is readily obtainable and harmonizes naturally with the surroundings. It is less heavy and cumbersome than the cement concrete pots in vogue. It is less costly than the wooden containers. Bamboo baskets make attractive containers but lack durability. It is important that the pots should not be painted with enamel or wood paints which may give them a bright appearance but affect the porous character of the pots and also make them look unnatural in the surroundings.

Pots have to be complementary to the potted materials and therefore their size and design will depend on the type of the material. A tiny cactus looking lonely in a 30 cm (12 in.) pot would not thrive. While the same cactus in a 10 cm (4 in.) pot may look at ease. Plants which need frequent watering with good drainage like ferns and orchids would do better in the pots with slit holes in the sides.



Fig. 15. Pot filling and refilling operations: (1) Hole at the base and a crock to cover it; (2) Providing a layer of crocks; (3) Covering with fibrous material like dry leaves, coconut fibre, straw, etc.; (4) Taking out a plant with soil and roots intact; (5) Putting the plant in a larger pot.

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In the books written for colder climates there is a mention of strawberry drums with holes of about 3 cm (1-1½ in.) diameter on the sides for planting strawberry plants. I have used the coal tar drums. For ensuring good drainage, in addition to the bottom layer of crocks and small stones, a chicken-wire cage, cylindrically shaped was put and closed at bottom and filled with stones, in the middle of the drum. One person held the wire cage while the other one filled the drum. My experience, however, was that the strawberry did not fruit well in the drums and the plants were not very healthy. The main reason was that when the sun shone brightly, the drums became hot and the plants did not seem to enjoy it. As an experiment they were shifted to the ground and their growth became luxuriant and they gave a rich crop of strawberries. I would not, therefore, generally recommend use of these drums in Indian conditions except at high altitudes with good rainfall. There too it is better to use them sparingly for flowering shrubs and annuals and not for fruits. To some degree, cement concrete pots also suffer from this defect of quick heating and cooling, exposing the plants to the shock of too much heat in summer and too much cold in winter.

Choice of pot material. Another important consideration is the choice of material for growing in pots. Pots require considerable labour in potting, tending and watering. I would, therefore, prefer plants which will provide a display of flowers over a long period or have attractive or variegated foliage, such as a succulent, fern, *Dieffenbachia*, *Maranta*, palm, *Hypostes*, *Mussaenda*, ivy, *Viuca*, *Philodendron* and orchids, and would avoid annuals as they add to labour. Of course, the choice is yours and some of the annuals like *Brachychome*, *Dimorphothecca*, *Linaria*, *Nemesia*, *Nasturtium*, pansy, *Phlox*, *Petunia*, sweet alyssum, etc., make lovely pots. And you may like to indulge in their cultivation

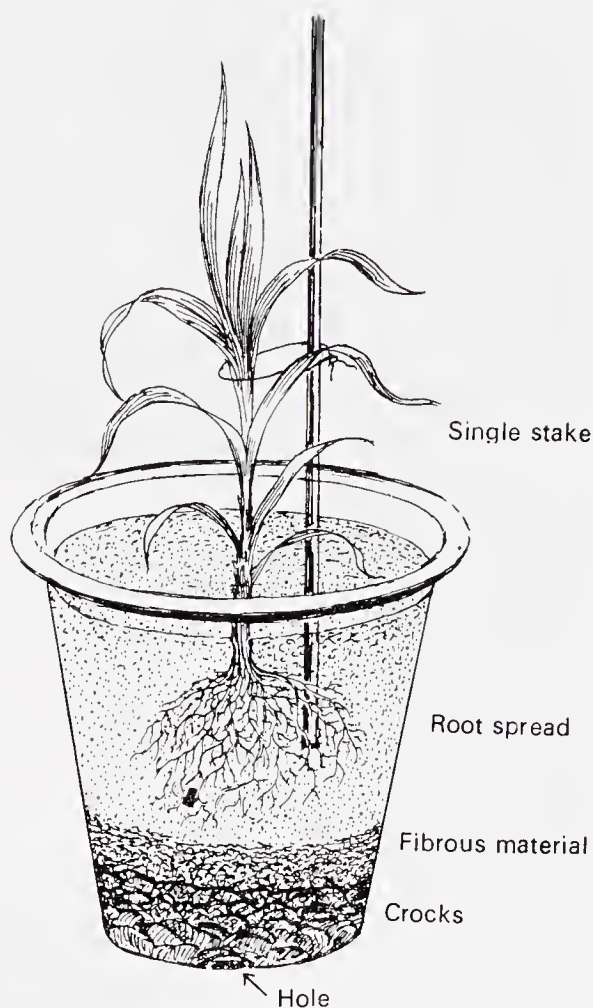


Fig. 15(6). Sectional drawing of a pot

POTS, POT CULTURE AND HOUSE PLANTS

if leisure or help permits. I love chrysanthemums in pots for the choice they offer of bringing colour inside the house. Similarly, I like the pots with colourful, trumpet-headed *Amaryllis*. Cacti and other succulents are a class by themselves and if you fancy them, they give blooms which look heavenly for their bright colours and translucence. One of the most splendid class of plants for pots is the *Pelargonium* (popularly known as *Geranium*). There are varieties with magnificent blooms and appealing foliage with variegated leaves in some cases. There are single and bi-colour and single and double varieties. There are semi-creeping types also.

Filling up of pots. Proper drainage in a pot is very essential. Therefore, there should be a hole at the bottom of the pot depending on the size of its base. A hole of 1.25 cm ($\frac{1}{2}$ in.) diameter should be sufficient for a base of 15 cm (6 in.) diameter, and 3 cm (1 in.) diameter for a base of 30 cm (12 in.). The holes should be fully covered with a crock, i.e. a piece of broken pot. It should be firmly placed in its position by covering with smaller crocks, small stones, small pieces of bricks or of charcoal. It is a better practice to put bigger pieces at the lower level and the smaller ones on top of them. Normally one-third of a pot of diameter of 15 cm (6 in.) or less is thus filled up with crocks, stones, etc., while for the bigger pots, the crocks, etc. are filled up to one-fourth of the pot. Its depth can be increased to one-third to half the depth depending on the requirement of the plant.

In order that the soil does not filter through the crocks, etc., and thus block the drainage hole, a layer of about 1 cm ($\frac{1}{2}$ in.) straw or dried leaves is spread on them. Pot is then filled up with the soil mixture and the planting is done as mentioned in Chapter 3. Care should be taken that the level of soil after planting is 1-2 cm ($\frac{1}{2}$ —1 in.) less than the top rim level of the pot so that the soil does not fall outside the pot at the time of watering.

Pots should not be allowed to rest on grass or soil directly as this chokes the drainage hole. An earthen saucer or a few stones or crocks may be placed underneath to prevent it. A 'pucca' base will also serve the purpose.

Pots must be turned from time to time to prevent the plants from growing unevenly towards the sun. Many plants, it is said, dislike the change in their direction when they are forming the buds.

Watering. Watering of pots should be done in such a manner that it soaks the bottom of the soil. The test for general purposes is that a little water should leak out from the drainage hole of the pot. Another good practice is to block a portion of the drain filled up with water and place the pots in it so that they can draw their moisture from the bottom. This can also be done by standing the pot in a saucer or tub filled with water. This helps in formation of strong healthy roots at the bottom. This is particularly suitable for delicate plants.

Repotting. Repotting is required when the plant is not thriving; its present container has become too small for its growth or the soil is exhausted or the plant has become pot-bound. Experience will also be a guide as to when repotting is essential.

The size of the pot should be proportionate to the size and root growth of the plant.

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A small plant in a large pot looks miserable, and the pot and the soil become more conspicuous. A bushy plant on the other hand, covering the soil and a part of the rim looks attractive. Besides the aesthetic value of the pot being proportionate to the size of the plant, the planting of cuttings or transplanting of seedlings in small pots promotes better root growth because the soil does not remain too wet and aeration is better. A little crowding of the cuttings, quickens their root formation. Beware of over-crowding too, which may prove to be fatal. The seedlings and small plants require shifting from smaller to bigger pots depending on their requirements. There are some plants like palms and cycads which are happier in a pot bound condition and, therefore, require smaller pots that are normally provided for that size of the plant.

In the rainy season, a *Furcraea* (succulent) plant in my garden showed signs of distress. After checking its roots, I transferred it to a smaller pot and put it on an empty pot standing upside down. It recovered quickly.

If the pots are not repotted after their flowering or the season's growth, it is a good practice to remove top soil of 10-12 cm (4-5 in.) to fill it up with fresh soil mixture immediately before or after its rest period when it commences its new growth.

Boxes and baskets. The baskets can be of wire frame, of wooden frame or bamboo. The boxes may be wooden or of cement. The baskets of frame-work are first lined with moss or coconut fibre and then filled with compost.

- In boxes and baskets, seedlings are planted more closely than in the pots because the plant is required to extend beyond the edge. In hanging baskets the plants are filled in the sides also from bottom to top to give it a round appearance. A good hanging basket gives a real feel of richness and fullness. The plants suitable for hanging baskets are those which are small, trailing, creeping, inarching or with small stalks or stems and attractive rosette shapes as small ferns like *Adiantum*, small bulbous plants like *Achimenes*; small annuals like sweet alyssum, *Nasturtium*, French marigold and violas, trailing plants like *Tradescantia*, *Zebrina* or *Cryptanthus*, and small succulents like *Sempervivum*. *Primula malacoides* also makes an attractive hanging basket with delicate coloured flowers rising clear above the light green foliage. One would normally not associate with a rather plain looking fern as *Nephrolepis* making an attractive basket. But, I saw an extremely pretty basket which was the first-prize winner in a show, with fronds well distributed all over, giving it a fine round appearance.

HOUSE PLANTS

The house plants are those which can be grown completely or partially indoors. By partially, I mean that they can remain indoors for a few days if they are cultivated outside, and are brought indoors from time to time. Annuals cultivated in pots can also be brought inside for occasional display but are really not house plants.

House plants are of various sizes, shapes, colours of their foliage or flowers. There are evergreens with attractive foliage like ferns, *Dracaena*, *Dieffenbachia*, *Monstera*,



109. A view of house plants arranged outside the sitting room. The collection includes *Cordyline*, *Dracaena*, *Oxalis*, *Aralia*, *Maranta*, *Peperomia*, *Scindapsus*, *Monstera*, *Alocasia*, *Fittonia* and *Begonia rex*



110. *Algaonema*



111. *Alocasia*



112. *Begonia rex*

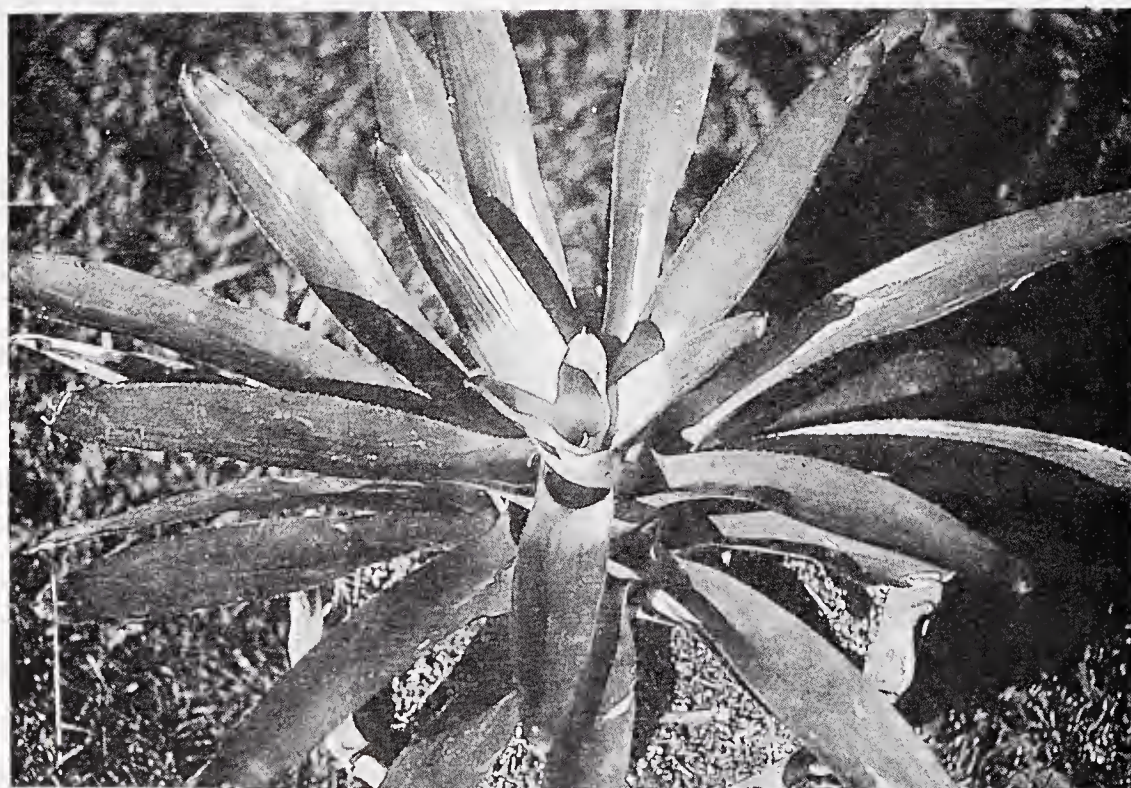


113. *Croton*



114. *Dracaena*

115. *Neoregelia*



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Philodendron, *Fittonia*, *Peperomia*, *Alocasia*, *Colocasia*, *Aglaonema* and *Maranta* and there are others with a riot of colour like *Pelargonium* (*Geranium*).

In selecting the plants you may first decide what effect you would like to create, and then choose the plant or if you have a wide choice of plants, choose the ones which would create the desired effect. It may be an individual plant selected for boldness of its form or of foliage to provide the room accent or it may be a group of plants for spectacular effect. A big plain wall is better for a mass display. As in cultivation, so also in arranging the pots, allow enough space to avoid overcrowding.

Plants with bright colours may be grouped with neutral colours or against a neutral setting. Against a vivid background, arrange plants with lot of white and grey in their flowers and foliage or with wide range of greys which foliage plants offer. Foliage may vary from cream-green shade to almost black purple or bronze.

Some plants have shining foliage like *Tabernaemontana* while others have furry or woolly or velvety finish like *Gynura*, the velvet plant, which has purple hairs and purple veins in velvety purplish-green leaves. There are plants with attractive foliage of various shapes, green or variegated, entire or scattered, as in *Philodendron*, *Pothos*, *Monstera*, *Syngonium*, etc. There are some with feathery-foliage like ferns or bold striking ones as *Caladium*, *Anthurium*, *Alocasia* or *Colocasia*. There are tall majestic ones like *Ficus elastica* and the informal delicate looking 'maiden hair fern'. There are climbing ones like *Philodendron* and trailing ones like *Tradescantia* or *Zebrina*. There are plants with glossy small foliage such as African violets, and those with variegated foliage as *Rhoeo discolor* or *Sansevieria*. There is the lovely silver grey of *Grevillea robusta*, or of *Cineraria maritima*, striking grey blue of *Eucalyptus globulus* and dark, glossy leathery green of *Clivia*.

In arranging pots, the colours and form of plants should either harmonize or make a pleasing contrast. Vertical lines of an erect plant may break the monotony of a compact or cylindrical shape of the grouped plants.

The sizes may be varied by combining short ones with taller ones. Round-leaved ones may be combined with narrow-edged or cut-leaved plants such as *Dieffenbachia* with ferns, *Philodendron* with *Maranta*, Rex Begonia with violas, palms with narcissus or *Zephyranthes*, *Monstera* with *Eunymus japonica* etc. The tall erect soldier-like *Dracaena* may be arranged with colourful coleus and informal lovely low-growing *Peperomia* or *Fittonia*.

Most of the plants seem to enjoy direct morning sunlight and cool summer nights. It is a good practice to keep them directly outside when the nights are cool until the early morning. Avoid frost and summer afternoon sunshine.

Pots may be kept in suitable containers when placing them inside the house. Cane and wooden containers look very attractive. Brass or glazed pottery containers are also in vogue, though they look a little artificial. In New Delhi, earthen containers with beautiful cut designs are available. These are my favourites as they harmonize better with the plants. For lending height a wooden stand or a pot or a bamboo basket placed

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upside down may be used. Earthen dishes under the pots prevent water in the pot from spoiling the floor and carpet.

All the foliage plants described in this chapter, the bulbous plants, particularly the foliage ones, palms and cycads, ferns, orchids, cacti and other succulents make excellent house plants. *Beaucarnea recurvata*, an exotic plant with round pitcher like base and concave inarching leaves is an object of universal admiration. Chrysanthemums and carnations also make lovely pot plants. The rose is not normally a pot plant, but given proper manure and feeding it justifies itself as a pot plant, also. So also bougainvilleas. *Araucaria* and *Ficus elastica* with their distinct presence lend dignity to any group of house plants.

The shrubs and semi-climbers can be trained attractively in pots in the shape of a small pergola, sphere or hyperbola or artistic standards around wavy stakes and branches of trees. *Asparagus plumosus* is one of the most attractive semi-climbers which adjusts itself beautifully to such shapes. *Tradescantia*, *Setcreasea*, ivy, *Hoya*, *Ficus repens* and *Scindapsus* (money plant) can also be trained similarly in small pots. *Philodendron* or *Syngonium* grown with the help of moss on a small branch makes a lovely standard. Some hedge plants can be trained as topiary. In fact, given the flexibility, a plant is capable of such numerous designs as one can imagine.

One of the most popular colourful shrubs for pot plants is *Pelargonium*. The other popular ones are *Acalypha hispida*, *Amaranthus*, *Beloperone*, *Camellia*, *Euphorbia pulcherima* (*Poinsettia*), *Forsythia*, *Fuchsia*, *Hibiscus*, *Hydrangea*, *Lagerstroemia*, oleander, *Prunus* and *Solanum psuedocapsicum*.

Some of the climbers popular as house plants, besides *Asparagus*, are *Hoya*, ivy, *Monstera*, *Philodendron*.

Choice can also be made from annuals, biennials and perennials. These have been discussed earlier, but a special mention can be made of *Cineraria* (annual), Canterbury bells (biennial) and *Gerbera* (perennial). I would like to make a special mention of the 'Polka Dot' plant (*Hypoestes*). With its purplish green leaves and pink dots, it multiplies very fast from a large number of suckers and the plants naturally grow from the seeds which fall. Another plant I found most attractive is *Vinca major variegata*, which has cream on green variegation dotted with single mauve flowers. Can be shaped or trained on a bamboo/wire balloon or allowed to wrap around an attractive piece of wood. Propagation from side root cuttings. There is also the unbeatable ivy (*Hedera helix marginata*) or other similar ones with variegated cream and green leaves. Propagation from aerial root cuttings. The *Mussaenda* is showy with its colourful bracts in white, cream, pink and rosy red. Many horticultural varieties of *Begonia*, a single genus, make a fantastic range of colourful potted plants.

Pelargonium is an irresistible pot plant for the hills and has been covered in detail in this chapter. Some of the other select ornamental foliage plants not covered elsewhere are discussed at the end of the chapter.

Pelargonium, earlier known as *Geranium*, it is one of the finest of the small shrubs

and makes one of the loveliest pot plants in the hills. It is not demanding in its needs and is always accommodating and gay so long as it gets plenty of sunshine and good drainage. In New Delhi it shows its distaste for the hot and humid rainy season. It needs protection from frost and in summer from direct sunshine. It is generally grown under roof projections, preferably on the east side.

The flowers can be seen in various shades of pink, apricot, rose, white, lavender, scarlet, reddish, purple, crimson and garnet-red, etc., in single- and double-petalled forms, and in single colours and bi-colours. There are varieties of the dwarf bush type, trailing type and tall bush type. The last two types do well in the hills only. The leaves may be pale-green, deep green, zone green or variegated, lightly lobed or deeply lobed, toothed or otherwise, hairy or otherwise; deciduous or perennial. There are many recognised varieties available abroad. Bangalore supplies some of the best varieties in India.

Pelargonium grows easily from cuttings 10-15 cm (4-6 in. long) which root in 2-3 weeks. In the hills, the cuttings may be taken at any time in the early or middle part of the summer. In late summer also, cuttings may be taken provided facilities of a hot house or inside window boxes on the south side are available. In the plains the cuttings are taken in September-October. The cuttings taken in the beginning of the rains are very susceptible to rot. To promote a bushy growth, pinch off the top of the stem by about 1 cm ($\frac{1}{2}$ in.) when the cutting is well established and is about 15-20 cm (6-8 in.). For exhibition blooms the growth may be restricted to 4-6 lateral stems and the axillary leaf growth may be pinched off. All these lateral stems will flower almost at the same time and the plant will look rich with colour.

The stem which has borne flowers should be cut about 10 cm (4 in.) above the base to promote and develop vigorous new shoots. But in the plains where the winter is short, such a drastic pruning would result in no other flowers during the season. In the plains only the top 5-7 cm (2-3 in.) may be pinched off after flowering to promote sublateral growth, if any. The plants raised from new cuttings taken annually or even half yearly give better and bigger blooms for a longer period than the plants which are pruned only after flowering.

Pelargonium is prone to leaf-spot disease. It is also susceptible to die-back. Its pests are aphids, scales, mealy bugs and leaf-eating caterpillars.

SELECT LIST OF ORNAMENTAL FOLIAGE PLANTS

Aglaonema. A medium-sized 45-60 cm ($1\frac{1}{2}$ —2 ft) plant with thick fleshy stems and shining leaves with depressed veins. Its cultivation is similar to that of *Dieffenbachia*. The common self-coloured species with depressed veins is *A. modestum*. Other common and sturdy ones are *A. commutatum* with deep green leaves with silver grey markings; *A. costatum* with deep green leaves spotted white and white striped along the central vein; and *A. oblongifolium* with pale green leaves and erect habit of the plant. There are

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other species with mottled, blotched or variegated leaves like *Dieffenbachia*. There is a pretty species with leaves which are red underneath and blackish-green above with red veins.

Aralia (Polyscias). An ornamental foliage shrub, widely grown in shade and semi-shade in warm humid regions. Forms excellent pot plants. It grows quickly and succeeds even in inferior soils and poorer conditions where other plants fail to grow. It is pruned during the rains. The popular species of *Aralia*, now grouped as *Polyscias*, are *P. balfouriana* with round or reniform leaves, coarsely toothed, green, grey-green or variegated; *P. quilfoylei* with leaves cut at various depths, olive green, grey-green or variegated; *P. filicifolia* has fern-like leaflets narrower than the above species, green or with pale-cream margin.

Asparagus. The genus *Asparagus* besides the edible *Asparagus* (Chapter 16) and the climber, *Asparagus plumosus* (Chapter 9) includes pretty foliage shrubs. One of the most common one is *A. sprengeri* with its spread of trailing branches and shining bright green, soft, needle-like foliage. It bears tiny white flowers, slightly fragrant. Likes sunshine and sheds off leaves if placed under shade. There is a dwarf variety *A. sprengeri* var. *nana*, a variety with variegated leaves makes a very attractive pot plant.

Aspidistra. A small plant with cluster of basal leaves of blackish green colour with narrow stiff stalks. There is a pretty variety with variegated foliage. It can be prevented from reverting to dark green self colour by rooting out the stalks bearing self colour leaves.

Begonia. See under Bulbous Plants.

Coleus. An ornamental foliage plant cultivated for its variegated leaves in beautiful combinations of green, yellow, brown, red, pink, carmine, etc., like crotons; mottled, striped or veined with frilled or plain edges. Easily raised from cuttings taken in October-November or from seed sown in March-April. Flowers are insignificant and should be cut back with 8-10 cm (3-4 in.) of the stem to allow the plant to develop bushy growth and retain its foliar appearance for a longer period. In the plains it thrives in semi-shade, preferably morning sunshine only. Grown from seed; the design of the leaves is apparent as soon as the first set of leaves appear. Can be screened at that stage. Liquid organic manure improves colour of the foliage. It can be propagated at any time except winter.

Dracaena and *Cordyline*. *Cordyline* and *Dracaena* are somewhat alike. The tall erect ones with long bare stems and cluster of leaves towards the top are generally *Cordyline*. They have tough leaves dark and coppery brown, brown and green, olive green, self-coloured or variegated with cream or pink, with or without carrot-red edges. Some of them are glaucous, while some others are purplish underneath. There are numerous varieties of *Cordyline terminalis* varying in different shades of colour of the foliage. In warm humid regions, they are considered as a group of the most colourful foliage plants for ground as well as pot. Plants of this species are propagated from cuttings of the main stems.

Dracaenas are prettier and offer more range of choice from the rosette ones to tall

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ones, with linear or broad leaves; bright green, pale green or olive green; striped, blotched or mottled; with cream or yellow mottling in the centre or in the margins.

D. deremensis. The varieties of this species have bands of white either at the centre or along the margins. *D. godseffiana* is a dwarf bush, leaves glossy green with yellow spots. *D. fragrans* var. *victorae*—a popular and colourful foliage plant. Long strap-shaped leaves have yellowish or silvery green centre bordered by cream to golden yellow. *D. metallica* has dark greyish purple-brown leaves. The young ones are pinkish-purple. It is an attractive *Dracaena*.

Dieffenbachia. Popular for its broad fresh green leaves mottled with cream. Easy to grow. It provides a homely atmosphere to an arrangement of house plants. There are species with contrasting midribs, with or without mid-stripes, self-coloured with prominent veins, linear leaves, pale green mottled or marginated with dark green. Propagation by nodal cuttings or air layering. Its juice is very poisonous and makes the tongue numb. Hence its popular name 'Dumb-Cane'. Excellent house plant and thrives in shade or light shade.

Euonymus japonicus mediopictus. An extremely attractive short-foliage shrub, 60-75 cm (2-2½ ft), in the pots. Its small fresh green oval foliage with green in the margin and yellow in the centre and base of the leaf is charming. The petiole and the stem are also yellow. Suitable for the hills and the sub-montane regions. It does well in Delhi also, under partial shade. It is very susceptible to the scales pest. To control this it needs the same treatment as for the roses.

Ficus elastica. An extremely popular foliage house plant with thick leathery-glossy dark-green foliage, with pale brown midrib and light green underneath. The rose-coloured sheath of top leaf in the young plant is very attractive. It is the Indian rubber plant which grows as high as 30 m (100 ft) and branches from the stems. Can be propagated from cuttings. It exudes milk juice on receiving a cut. Its tall erect neat habit makes it very suitable for arrangements of house plants. Suitable for the plains but did quite well in Shillong when kept in the porch getting morning sunshine. It has varieties with variegated foliage or with red midrib. *F. krishnae* is attractive for the unusual shape of its leaves, which form a small pouch at the base.

Fittonia. A creeping slow-growing plant very pretty for its deep veins marked white, rose or brown-red contrasting beautifully with its dark olive green foliage. It forms roots at the nodes touching the soil. Propagation from cuttings. *F. argyroneura*, *F. verschaffeltii* and *F. pearcei* are popular species with beautiful foliage.

Peperomia. An attractive evergreen, very dwarf foliage plant with leaves arranged almost like a rosette. The distinguishing feature of its leaf is that all its ribs emanate from a central point as in *Begonia*. The portion between the ribs is raised. Like Rex Begonia, it can also be propagated from a leaf cutting, besides the usual stem cutting. The popular species are *P. elusiaeifolia* with metallic olive green leaves with purplish-red margin; *P. obtusifolia* 'variegata' has pale green leaves with broad greenish-white variegation towards the edge; *P. peltifolia* has slightly depressed ribs with grayish green leaves and

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silver markings; *P. sandersii* is extremely pretty with bluish-green glossy leaves and thick silver bands along the veins. There are many other species with silvery, gray-green, metallic green foliage with stripes of silver, yellow, brown-red, rose-pink, etc.

Pilea muscosa is a low fern-like plant with tiny leaves spreading like moss. Excellent for rockeries, hanging baskets, and plant edging in semi-shade. Suitable for the tropics. Propagation from cuttings is easy. The plants look very attractive as undergrowth of a shrub. *P. cadieri* is strikingly showy with its metallic green leaves with white patches which shine, hence its popular name as the 'aluminium plant'.

Rhoeo discolor. A stemless bushy plant of green leaves, purple underneath and tiny lilac flowers at the base of the leaves. It has fleshy roots. Propagation by root division.

Ruscus. A very unusual foliage plant with blackish green smooth glossy leaf-like stems. A perennial, it is at home when grown under the trees in combination with other shade-loving plants. It bears a tiny off-white flower on the middle of the leaf-like stem. Common species is *R. hypoglossum*. There is a prettier species, *R. aculeatus*, in which the tiny flower is followed by a red berry.

Setcreasea, *Tradescantia* and *Zebrina*. They are alike with their trailing habit and capacity to form roots at the nodes touching the soil. They are excellent for hanging baskets. Propagation from cuttings is easy.

Setcreasea is comparatively slow-growing. *S. purpurea* has purple foliage which is particularly attractive in bright sunshine. Soft pale green hair on purple stems make a pleasing contrast.

Syngonium. A semi-climber like *Philodendron* trained on a moss-covered thick stake is very attractive, specially those with variegated leaves looking almost creamy white.

Zebrina and *Tradescantia* are so alike that one is likely to be confused with the other. They have leaves greyish-green, yellow-green or brown-green, mostly striped with dark brown or white on the upper side, and purple, brown or green plain colour on the underside. The stems are thick and fleshy, sometimes with soft hair. The tiny flowers are also quite attractive. They have remarkable adaptability to cold, heat, humidity and dry conditions. Very easily propagated from cuttings.



116. A thatched arrangement on the terrace of multistoreyed building



117. A terrace garden with a lawn

14

TERRACE GARDEN

A terrace garden is an urban feature. In India, it is a feature of the plains mainly because in the hills the roofs generally have steep slopes. I earlier saw flat roofs in the hills only in the Lahaul Valley of Himachal Pradesh but with cement concrete buildings coming up in the hills also, flat roofs have become more common in the hills.

A terrace garden may be a continuation of the ground garden for those who have the unique advantage of possessing both. It may be a substitute for the ground garden for those who are not so fortunate. As a substitute it is like a poor relation and has to function under certain limitations. Yet, with all the limitations, a fine garden can be had on the terrace.

Limitations. It is better to understand the likely limitations before planning the terrace garden:

- (a) scarcity of water supply;
- (b) difficulty of transport of loam, manure, etc.;
- (c) difficulty of transport of heavy containers;
- (d) limited choice of plants as plants with deep roots will not be able to grow;
- (e) requirement of more labour;
- (f) more cost of garden operations;
- (g) special shade arrangement for the plants during the summer or winter;
- (h) special requirement of leak-proof and load-bearing floor; and
- (i) special requirement of drain pipes.

Most of the terrace gardens are in the rented flats. The gardeners are, therefore, reluctant to invest in any improvement in floor or drainage system. Without these improvements the scope of the terrace garden gets further restricted to pot culture only and only the plants which do well in pots can be grown.

Provision of extra facilities. To implement even the terrace gardening limited to pot culture, the gardener will have to make arrangements for adequate water supply and a shade for the plants. Plants which need no shade on the ground will need this on the

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terrace as it gets much hotter and colder and is more exposed to sun and wind than the ground. Besides, there are small trees or roof projections of the house where these pots can be accommodated during very hot or cold weather but such a facility is not available in the terrace garden.

For water supply, the gardener would generally depend upon the source of supply provided by the Municipal Committee or Corporation. Therefore, he will have to assess how much water supply is available and whether he needs to restrict the number of plants. He will also have to choose the time for watering the plants according to the availability of water or will have to provide a small tank or tub to store water for the garden. The investment on this account will be:

- (a) fitting up a tap on the water tank if such a tank exists;
- (b) plastic pipe of 1.25 cm ($\frac{1}{2}$ in.) diameter, $1\frac{1}{2}$ times the distance between the tap and the farthest point on the terrace. The additional length is provided as the pipe is seldom taken in a straight line from the tap to the plant. It has to avoid other plants and follow some curves of the intermediary terrace walls; and
- (c) a tank or tub, if necessary, for storage of water.

For shade, light mat-like material through which air and sunshine can filter supported by a frame would be required. The material popularly known as 'sirki' with bamboo supports would meet this need. For an area of 7.5 m \times 3.5 m (25 ft \times 12 ft) and height of 7 ft (2.2 m) about 6 to 8 bamboos would be required with two 'sirkis', taking advantage of an existing wall on one side.

The disadvantage in this shade-material is that it needs frequent replacement at least once a year and it also tends to get blown off in strong winds specially in the summer. But it would be a fatal blunder to provide shade by a non-porous material like plastic or tarpauline which would make the area like a hot case and also deprive the plants of free circulation of air, sunshine, rain and dew.

These improvisations together with usual garden tools and accessories and sound knowledge of pot culture should equip one well for making a terrace garden.

I maintained a terrace garden on two different occasions in New Delhi for nearly ten years. I find it entailed considerable extra labour of moving up soil and manure. It was difficult to make your own leaf mould as a compost pit could not be made. The big pots broke and the thatch cover blew off very often due to strong winds. I could never reconcile to terrace gardening as a substitute to ground gardening. There was, however, some compensation in the fact that pests and diseases were less in the terrace garden.

VEGETABLES AND FRUITS

Growing of vegetables in pots or wooden boxes is more cumbersome and time-consuming and achievement is limited. I found, on the whole, the experience to be less satisfying. I would therefore, not indulge in vegetable-growing on a terrace garden. If,

TERRACE GARDEN

however, you are keen on vegetable growing, only those vegetables may be grown which are very shallow rooted, quick growing and are required frequently and fresh, e.g. a few herbs like mint and coriander, lettuce, onions for salad and Chinese radish. The labour on tomatoes is repaying and an exception can be made with regard to them. To this I would add a curry leaf plant and a few plants of pungent chillies. I would also not resist the temptation of growing a few fruit trees and bushes. In the fruits for the plains I would recommend 'Beauty Seedless' grape, 'Karaunda' and 'Kagzi' lime. These can be grown in containers of about 45 cm (18 in.) diameter. Strawberries can be successfully grown in pots of 25 cm (10 in.) diameter.

FLOWERS

In flowers, a combination of flowering shrubs, climbers, foliage plants, coupled with a few annuals or perennials and bulbous plants would be a choice combination. Cacti and succulents may be added if you like them. There is excellent scope for cultivation of 'Bonsai' if you fancy them. Hanging baskets look charming. Climbers can be trained on the shade-frame and would cover it beautifully.

TERRACE WITH LEAK-PROOF AND LOAD-BEARING FLOOR

If you have a terrace with leak-proof and load-bearing floor fitted with suitable drain pipes, you can have all the thrill of a ground garden — a lawn with a herbaceous border, small hedge, climbers, pots and hanging baskets, and even a water pond with a fountain too.

The roof should be given the terrazzo finish. Planters may be built on the wall edges. Supports for climbers may be provided at suitable corners. Pergolas with hedges may separate one section from the other. Drain pipes may be fitted at suitable points for discharge of surplus water without causing annoyance to the neighbour downstairs.

In a bigger terrace garden, besides the vegetables and fruit trees already mentioned, *phalsa*, pomegranate, hybrid dwarf mango and other varieties of grapes may be added in fruits. All the vegetables mentioned in Chapter 16 can be grown but considering additional labour and cost it is better to restrict the vegetable garden on the terrace, to a very small area only.

One of the loveliest terrace gardens I have seen is in the Defence Colony in New Delhi. A 'Mary Palmer' bougainvillea was transferred from its earlier home to the present one with roots intact. A hole had been made for it to pass through the cement concrete roof projection at the time of construction of the house. It has flourished and has made a canopy of the creeper on the first floor where it proudly displays its colourful blooms. It has now been trained to reach the second floor along the staircase. There is a lovely lawn and water-pond with golden fish. Flowers hang in baskets of exquisite

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designs. Red verbenas are allowed to trail down the railing showing its beauty to the passers-by. All this is an area of only about 6m × 4m (20 ft × 13 ft). A room with thatched roof, on the second floor gives the garden a real rustic appearance in the midst of an aristocratic locality and provides a comfortable home for the seedlings, seeds and bulbs.

15

OTHER GARDEN FEATURES

THE main garden features have been discussed earlier. The others which are equally important but not so dominant are discussed here.

GARDEN PATHS

A garden path, besides being functional in providing suitable surface to walk upon, can be a piece of beauty and an architectural feature in itself. Garden paths should be as few as possible, and should run from one point to another direct in a few bold, graceful and gentle sloping curves. Paths in straight lines intersecting each other at right angles are suitable for very formal gardens only. Material available locally may be used without sacrificing originality. Whatever be the material, size and design, the path should merge in the surroundings, should be smooth to walk upon and should not get slippery, particularly in the rainy season. A path interspersed with clumps of rock plants arranged in an irregular manner looks very attractive. Ruggedness of a stone path can be subdued by grass lining at regular or irregular intervals.

Brick path. Bricks arranged as in the walls have a formal effect. They may look attractive in an informal setting also. But better would be broken bricks joined together in irregular shapes; this will be cheaper too.

Stone path. Stones are available in many natural hues, in regular as well as irregular shapes, and create delightful effects. River stones in natural colours and shapes also make excellent crazy pavings, provided they are properly imbedded in the soil or sand. Their smoothness lends softness to the scene. Stones can be substituted by mortar rubbles in irregular shapes.

Coal pavings. In areas where coal is available in plenty, coal paving can be unusually attractive and functionally effective.

Gravel path. Small boulders, topped with red gravel and beaten firm can also make

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an attractive garden path contrasting beautifully with the green of the plants.

ROCK GARDEN

A rock garden means an arrangement of rocks with plants growing in the crevices. It brings the 'feel' of the hills to the home and is, therefore, a refreshing feature. Its bold ruggedness is a pleasant contrast to the softness of the flowers.

A rock garden must look natural as if it had been there and not as if it has been superimposed. The rockery should be functionally effective in providing a suitable home for the plants to grow. Advantage of a natural curve or slope in the land can be taken to make it.

The stones help the plants in retaining their moisture and keeping their roots cool. They also protect them from heavy rains, frost and wind and provide good drainage. I

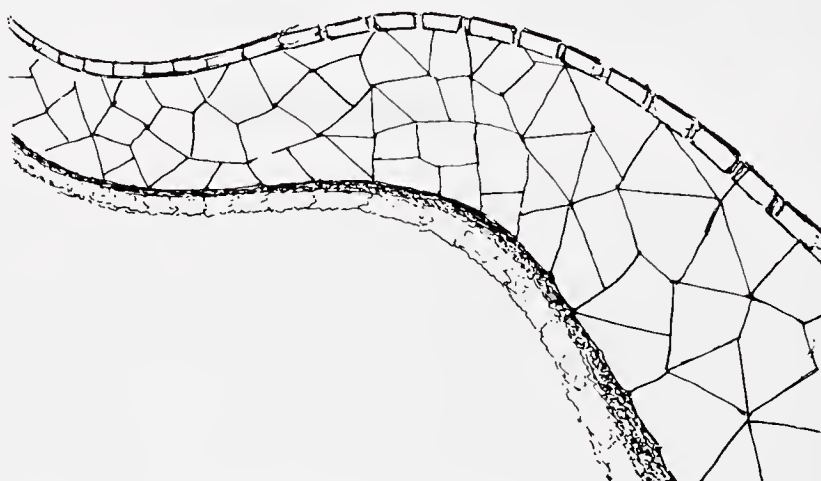


Fig. 16 (1). A crazy garden path

have seen a gentle slope created artificially in such a subtle manner that it looked natural with the sweep of the lawn over the slope.

Rock wall. A rock garden can also be provided in the form of a rock wall. The rock wall should be made, only if necessary as in a sloping garden and then filled with plants.

Rock plants. In the hills, a very wide range of plants called 'alpines' can be grown to bloom successfully, 'alpines' means those plants which grow in rocky positions at high altitudes. These include *Achillea*, *Achimenes*, *Ageratum*, *Azalea*, *Begonia semperflorens*, *Bellis*, *Campanula*, *Cyclamen*, *Dianthus*, *Gazania*, *Gentiana*, *Helianthemum*, *Iberis*, *Linum*, *Primula*, perennial *Phlox*, *Saxifraga*, *Saponaria*, Shasta daisy, *Sempervivum*, *Verbena*, *Zephyranthes*, etc. Small ferns like *Adiantum* in partially shady and moist

118. A formal garden path of stones and grass balanced by mass of informal nasturtium





119. A water garden

120. Water lily





121. An open greenhouse for orchids in New Delhi facing east, and covered with creepers on three sides. The flowering vernaia looks attractive

OTHER GARDEN FEATURES

corners and cacti and other succulents in sunny positions can be interspersed with these plants.

In the plains, the plants have to be those which are found in the hills of the plains. In the European and American books, the emphasis is on the rockery in the open sunshine. This can be appreciated due to temperate climate of the region but need not be rigidly applied to Indian conditions. In India, a rockery may be in the open sunshine, partial shade or light shade. Heavy shade with drip of a thick-foliage tree like *Ficus* is fatal, particularly, if the rockery is situated on the north side. On the sunny side, some of

the cacti, succulents, *Daedalacanthus*, *Lantana*, miniature roses, *Setcreasea purpurea*, *Verbena erinoides* can grow successfully, while ferns, *Fittonia*, *Peperomia*, *Monstera*, *Rhoeo discolor*, *Rivinia*, *Sansevieria*, *Scindapsus*, *Ruscus*, *Tradescantia*, *Selaginella*, *Zebrina*, etc., may grow well in shade or semi-shade. Ferns also look natural on the rockery slopes in shade.

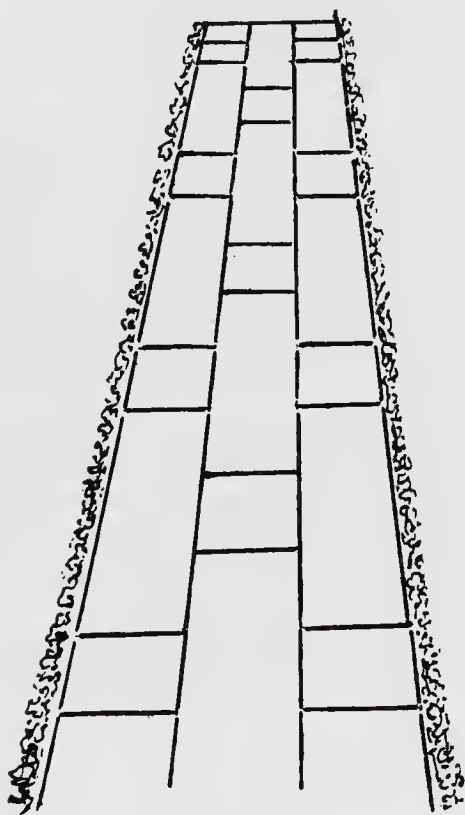


Fig. 16 (2). A regular garden path

WATER GARDEN

A water garden can be very personal and charming. There can be nothing more relaxing than peaceful gurgling of water. This is possible if a running water course is available. It can be combined with a rock garden, water plants and water-side or marsh plants as if the water course has made its way through the stones and the plants are growing naturally.

A water garden need not be confined to the traditional form of a water pond with gold-fish. It may have a water course, a water pond and a water fountain or any one or more of these features. The water fountain can be so combined with a waterfall and stones that the sweet gurgling sound can be heard. A water garden should not be directly exposed to the sun. It will also need a certain background to give it a natural setting. Trees and rocks are most suitable for this purpose. A weeping willow overhanging the water garden provides a restful setting. Fish are not only ornamental in ponds but also keep in check the larvae of mosquitoes. Look out for king-fishers who are a danger to these fish. Oxygenating plants such as *Sagittaria*, *Vallisneria*, *Carlomba carolinana*, *Anacharis* and *Elodea* remove the nuisance of clouding of water. If children below five are around, it is better to fence the pond. A depth of about 75 cm ($2\frac{1}{2}$ ft) is

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considered good for a water pond.

Water gardening provides for cultivation of water plants, marsh plants and moisture-loving plants. The most popular water plants are the water lilies (*Nymphaea*). They are colourful and some of them are fragrant also. The right depth for the water lilies is essential. Those which grow at shallow depth are more delicate. Some of the popular water lilies are *Nymphaea capensis* (deep blue), *N. caerulea* (pale blue), *N. lotus* (pure white or white with pink or red at base of petals), *N. pubescens* (white), *N. rubra* (large double, deep red), and *N. stellata* (medium to large flower, pale blue). Lotus, known as water bean (*Nelumbium speciosum*) is a beautiful flower and is also popular because of its use for religious functions. Patera or bullrush (*Typha latifolia*) or *Typha angustata* has attractive heads like *bajra* which are popular for floral decoration. Water hyacinth, a nuisance in village ponds, with its dainty light lilac-blue flowers and round glossy leaves looks pretty in a small corner of the water garden.

The marsh plants may include arum lily (*Calla palustris*), *Cyperus* and certain irises, primulas and *Saxifraga* (*Iris foliosa*, *Primula japonica*, *Saxifraga pellata*). *Cyperus alternifolius*, known as 'Umbrella plant' because of its erect stem and foliage of dark narrow leaves spreading out like an umbrella at the top, can be put on the mud bank or in a pot and kept in water. Arum lily with its large white heads of flowers like *Anthurium* and thick dark green large leaves along the water bank is a lovely sight. Unfortunately it does not do well in the plains.

Moisture-loving plants in well-drained positions may be *Alocasia*, *Anemone*, *Colocasia*, *Hedychium*, *Hemerocallis*, *Kniphofia* (red-hot poker), *Mimulus*, *Ranunculus* and *Saxifraga* as smaller plants, and *Azalea*, *Daphne*, *Hydrangea*, maple (*Acer*), *Rhododendron*, *Sambucus niger* and *Spiraea* as shrubs or small trees. Though not so common, *Vaccinium* and *Agapetes* would also look attractive in the hills. Ornamental grasses and bamboos also look pretty by the water side.

From the water garden, the growing interest may take the gardener to the birds and fishes. It is a vast and an interesting subject.

MINIATURE GARDEN AND PLANTS

Plants may be miniature in nature or may be man made, known popularly as 'bonsai'. 'Bonsais' are made by restricting roots and shoot growth by growing the plants in shallow containers and by following some cultural practices like pruning, pinching and ringing. Plants may also be dwarfed by grafting on root-stocks which are miniature by treating with dwarfing chemicals.

Miniature containers. Plants which are miniature in nature include a very wide range of plants like some species of ferns, cacti, and other succulents, *Geranium*, ivy, primula, bulbous plants, miniature roses, etc. A tiny plant, *Cotula barbata*, 8-10 cm (3-4 in.), joyously bearing yellow globular flowers with fine foliage in February in New Delhi deserves a special mention. It is a real miniature plant.

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The miniature plants can be grown from thimble-size containers to pots of 25 cm (10 in.) diameter, from a shallow household dish to a pot of 10 cm (4 in.) depth.

Miniature garden. From cultivation of miniature plants to the planting of miniature gardens with shallow ponds, toy bridges, streamlets, wood-lands, etc. is a world of fancy to some. I find the subject fascinating so far as the plants are miniature in nature. When it comes to dwarfing a pine tree in shallow pan, it looks to me like a bird in captivity or to make a midget of a tall handsome person. However, the gardeners are free to indulge in their personal preferences.

BAMBOOS AND OTHER ORNAMENTAL GRASSES

Bamboos and other ornamental grasses belonging to the family Gramineae deserve a special mention as they have distinctive personalities which introduce original features in the garden. Bamboos may be giant, medium or small; green, yellow or yellow with green. They are tall and elegant. They can give an effect of pleasing formality. Grasses are most informal. They sway and sweep and seem to enjoy any position given to them. Pampas grass (*Cortaderia argentea*) bears silver white, feather-like flower-heads. *Pennisetum longistylum* bears small pink *bajra*-like flower-heads. *Phyllostachys* is one of the most graceful short ones. These and many other grass flower heads are also popular for flower arrangement. One of the attractive as well as useful grasses in open sunny positions in Meghalaya is the broom grass (*Thysanolaena maxima*).

GARDEN LIGHTS

Garden lights can be most ingeniously introduced in most unobtrusive manner, heightening a curve, a bush or a bed as desired in different shades. The water lilies may swim in blue-green lights, red roses may be bathed in red light. White *chandni* (*Tabernaemontana*) may be left alone 'untouched by hand', to show its shining foliage and pure white bloom at its best in the moonlight. A beautiful arrangement I once saw was the shades made of green strips of metal joined vertically together, hidden in a lemon tree at the end of a lawn.

GARDEN TOOLS AND ACCESSORIES

For ordinary household purposes, in our country where cheap but not skilled labour is still available, I would recommend the following garden tools to start with:

Land preparation

1. *Dao*: A kind of handy sickle used commonly for cutting trees and shrubs.
2. *Phawada (Spade)*: One of the most useful ones I have seen is the spade used in the Khasi Hills and is popularly known as Khasi Spade. Though more

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suited for hilly terrain, it works effectively in the plains also. It is light and handy and can be used by women and older people.

3. *Sabbal*: A kind of long hoe.

Maintenance and development

4. *Short hoe*: There are two types — one with the broad rounded front for bigger areas and the other with narrow rounded front for fine work like lifting seedlings, etc.
5. Hand fork for airing smaller areas (or a rake with long handle for larger areas).
6. Water cans (two — one of them with a fine hose for spraying seedlings, etc.).
7. Hand sprayer (This is a very useful equipment for spraying insecticides and for watering seedlings; also can substitute the fine hose).
8. Secateur.
9. Hedge shear.
10. Edging iron for keeping the edges of the lawns trim.
11. Budding knife.

Harvesting

12. Improved sickle (fast and effective; different from the normal moon arc type).

To these may be added a Tubular Hand Maize Sheller in case larger quantity of maize is grown. The ICAR, Shillong Centre, has developed this and a multi-purpose weeder which is fast and versatile. In addition, the following are required:

1. A wheel barrow or in its absence bamboo baskets.
2. Wooden mallet for levelling.
3. A garden line — a few sticks of about 25 cm (9 in.) size tied at regular intervals to the ends of a coarse jute/nylon string, to draw straight lines.
4. A light roller and a lawn mower can perhaps be borrowed.

The garden accessories may also include a container of non-corrosive material like a big earthen or cement pot for fermenting liquid manure and a mat loosely made of reeds as a shade for the seedlings or a screen in a small garden. A flit gun may be used as a substitute for a sprayer. If pesticide is used, it is better to keep two separate sprayers, one for water and liquid manure and the other for pesticides. The liquid manure may block the fine holes of a sprayer, and, therefore, will need to be strained with a fine cloth for using a sprayer. I normally find that liquid manure can be easily applied with normal water-can and the sprayer need not be used.

A number of new and sophisticated garden tools are coming into the market. Instead of rushing to stock them, it is better to start with a few essential ones and experiment with new ones from time to time. These new introductions cover a range of operations such as staking, wide labelling, weeding, hoeing, mowing, barrowing, clipping, pruning, hedge-trimming, watering, etc. Modern sprinklers and sprayers, which create mist effect, stakes with rings, plastic twine with hand pulleys, weedicides,

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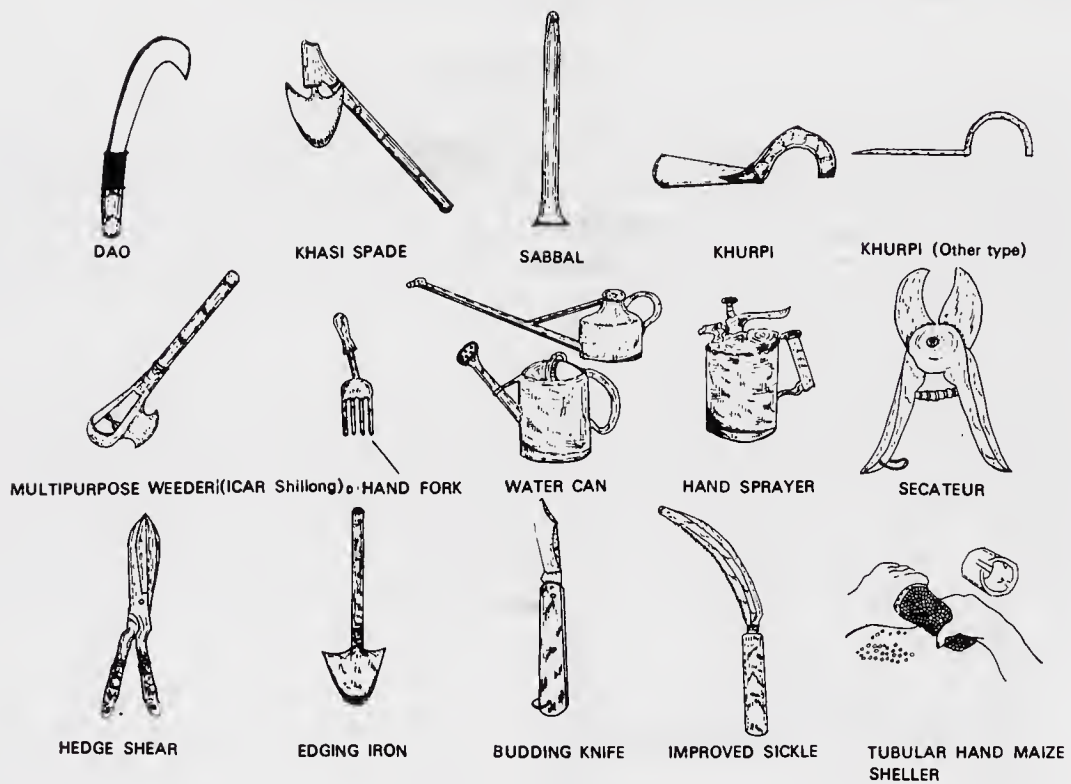


Fig. 17. Garden implements

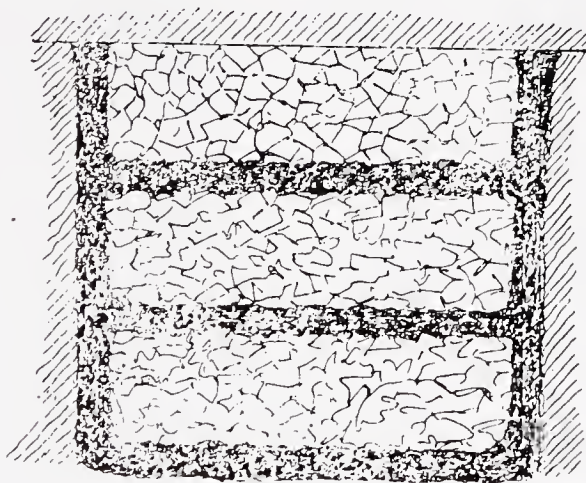
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measure beakers, clipping and trimming with electric hedge trimmers, new kinds of secateurs, two-wheel barrows instead of the traditional one-wheel one, automatic motor mower with a seat for a driver, electric digger, machines with a number of attachments for a number of garden operations, stainless steel garden implements, plastic covered chainlinks, fencing to check bird damage, electric pruning, etc. Those interested in reading about modernization of garden operations would find it very interesting to page through the book, *Gardening the Modern Way*, by Howard Ray, published in co-operation with the British Royal Horticultural Society, London.

COMPOST PIT

The length and breadth of the compost pit may depend on the site available. Normally 1.3 m \times 1 m (5 ft \times 3 ft) is a good size. The depth of the pit should be 90 cm (3 ft) irrespective of its length, or breadth. It would normally take about six months for a good compost to be ready. There should be two pits or even one pit divided into two parts so that while the compost is made ready in one, the compost already ready in the other pit or part can be used.

All household and soft garden refuse which is liable to quick decay, should go into the compost pit. It may include vegetable and fruit refuse, fresh, decayed or semi-decayed leaves, straw, farmyard manure, soft wood, etc. Spread this refuse up to about 15 cm (6 in.), top it with a layer of cowdung manure about 3 cm (1 in.) and earth 3 cm (1 in.). Water it and repeat the process till the pit is full. Top it with soil 3 cm (1 in.) and close.



- (a) Make a 90 cm (3') deep. (b) Fill up to 25 cm (10") with garden and kitchen refuse. (c) Sprinkle lime. (d) Cover with cowdung manure 3 cm (1"). (e) Cover with soil 3 cm (1"). (f) Repeat three times in a pit.

Fig. 18. A compost pit.

Except the top layer of soil, the others should not be too compact otherwise bacteria will not develop. It is recommended that the contents of the pit should be turned over from time to time. This is, however, a cumbersome process. It is enough to water it from time to time and it should be ready in about six months. Sprinkling of ashes or lime on each soil layer will keep material sweet and accelerate its decomposition. Woody branches and other material difficult to decay may be burnt and the ashes may be added along with the rest of the material.

Compost accelerators are used in some countries but I have not heard of them in India. However, application of rock phosphate 50 kg per cubic metre

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area helps. Short attractive hedge like *Spiraea corymbosa* or a light climber like *Solanum jasminoides* in the hills and a quick-growing non-thorny hedge as of *Putranjiva* or a climber like *madhumalati* (*Quisqualis indica*) in the plains. Another interesting way to utilise the space is to make a bamboo or wooden frame and cover it up with a vegetable like 'squash' (*Sechium edule*) in the hills or pumpkins or gourds in the plains.

GREENHOUSE AND HOT HOUSE

These specially designed houses are essential for advanced horticulture. They have not yet become common in India. Mechanical control of temperature and humidity is very costly. For ordinary household purposes, if delicate exotic plants are not cultivated, a small sheltered corner of the garden can be converted into greenhouse by making a bamboo or wooden framework which is covered on three sides except the East with thick evergreen creepers. Copious watering of the plants or fixing a rotating fountain with a fine nozzle will take care of the required humidity. All plants enjoy morning sunshine, therefore, they should be allowed to bask in it. Wooden or bamboo frames which need frequent replacement can be substituted by iron frame or rough cement concrete pillars. Smooth pillars will look too artificial in such surroundings.

Hot house is not so essential in the plains as in the hills. Select a site on the south or south-west side. Make an enclosure with glass panels and wooden or iron frame on all sides sloping from the roof line. Some arrangement for ventilators or windows may be allowed to air the enclosures when it is hot. This would make just the difference required for the delicate plants.

16

VEGETABLES—A KITCHEN GARDEN

A kitchen garden is an essential part of a home garden and would need great care in planning. Some people think—“flowers for pleasures and vegetables for profit”—but I do not agree. A fresh lettuce, crumbling in the mouth, gives as much pleasure as a lovely red rose; shining, glossy, dark brinjals are more a feast for the eye than the palate; red, ripe tomatoes look pretty and taste delicious.

PLANNING

The total space and the position of kitchen garden having been decided under the general plan of the garden, the considerations, which would determine the plan for kitchen garden are discussed below.

The type of vegetables which will grow in the given plot will depend first of all on whether one is in the hills or the plains, after that on its position whether in the sun or shade or semi-shade. Generally, the vegetables like direct sunshine but the herbs do not mind shade. In fact most of the herbs need shade in the summer. Tubers like Artichoke Jerusalem or *Colocasia* also do well in shade. Under semi-shade, i.e., under trees or hedges, lettuce and radish can be grown. If trees shed off leaves, cucurbits, shallow-root vegetables and onions can also be grown under them.

The vegetables which the family like to consume raw and fresh, like carrots, cucumber, peas, radish, tomatoes and turnips, may be given preference over others which are generally taken in cooked form. If you are very fond of roasted maize cob, it would be a delight to pluck it fresh and roast it. A maize cob loses considerable sweetness 6-8 hours after plucking and most of it after 24 hours.

Vegetables, which are not readily available in the market, but the family is fond of, could be another consideration; for example, celery for those fond of soups. Vegetables, which give the largest edible material in proportion to the space occupied, may be another criterion for preference.

VEGETABLES—A KITCHEN GARDEN

Another consideration in planning would be to try to ensure supply of vegetables at a time when these are scarce and expensive in the market. For larger kitchen gardens, more emphasis may be on the vegetables which can be stored, like onion, garlic, potatoes and ginger. Beans and peas, may be another group for such a selection. The vegetables which can be picked easily like cauliflower and carrots may be preferred.

It is better to plan a separate small orchard for a few fruit trees in the garden. A few vegetables and herbs can be raised as intercrops. But if the space does not permit, a portion of the kitchen garden may be allotted to the fruits. The fruit trees proposed to be provided in a small kitchen should be dwarf and towards the corner of the plot; otherwise their shade and drip would affect the quality and culture of vegetables. The best situation for the fruits will be north and north-east.

Tall-growing vegetables should be grouped in such a manner that they do not shade the dwarf ones. Vegetables which can be planted and harvested at almost same time may similarly be grouped together.

For continuous supply of vegetables over a long period without causing excess at any time, the seeds may be sown at fortnightly intervals like lettuce, carrots, beans, peas, beetroot and turnips.

Advantage can be taken of a number of varieties of a vegetable, as early, main crop and late. This also ensures continuous supply of selected vegetables over a long period. Care should be taken that an early variety should not be sown late, otherwise it may give a 'button' head or bolt. A late variety, if sown early, may become too leafy and produce a small head. Besides being sown early, early varieties take less time for maturity. The late varieties may be sown at the same time as the main crop or may follow the main crop sowing and take longer time to mature.

One of the most important features of planning vegetable gardens is rotation of vegetables. Requirement of nature for food for each family of vegetables differs from the others. If the same vegetable or vegetables of the same family are grown in the same plot, the soil is likely to get exhausted. The principle of vegetable rotation, thus is to follow a shallow-rooted crop with a deep-rooted one. Similarly, a root crop may be followed by a leguminous crop which would store nitrogen in the soil; for example carrots should be followed by beans. Rotation of crops is essential not only for soil fertility but also for insect and pest control.

Intercropping is an important feature of vegetable garden planning. Intercropping must be such that before the plants of one crop grow too tall to shade the other, the smaller one is harvested. Thus, the long-duration and short-duration vegetable crops may be combined; for example cabbage, cauliflower, celery and brinjal as long-duration crops combined with *palak* (Indian spinach), radish, coriander, lettuce, parsley, knolkhol, fenugreek (*methi*) and turnips as short-duration crops.

If any disease appears in a plot, it is advisable not to grow the same vegetable in the same plot next year.

The compost pits as discussed earlier may be in the shadiest corner of the

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vegetable garden.

A mention may be made of mushrooms, specially the paddy-straw mushroom (*Pleurotus*) for their popular appeal for the table and the ease of cultivation. It has high economic potential too with very low investment and can fetch over 100% profit within a short period of two months. It can also be an excellent agro-based household industry.

VEGETABLE CULTURE

The general principles of cultural operations are the same as discussed in Chapter 3. However, some of the essentials are re-emphasized and details are filled in here.

The jack fruit is a wonderful tree. It provides a tasty vegetable when unripe and a delicious fruit when mature. The ripe fruit will, however, require a cultivated taste. Its leaves serve as a fodder and its rich deep green colour with leathery texture of the leaves makes it very attractive. The wood is good as soft wood and is very popular in the north-east India for photo frames, etc. Its yield is plentiful. Another tree popular in south India for vegetables is the Bread-fruit tree. Its foliage is also handsome. A mention may also be made of the 'multi-vitamin and multi-mineral packed leafy vegetable' *chekurmani* (*Sauropus androgynus*). Its leaves, tender shoots and fruits all are edible. It is considered superior to *palak*, spinach, etc. in nutritive value. Does well in shady positions and in humid places with high rainfall. It is reported to have medicinal values. Can be grown as a hedge or single plants. In the north-east, specially in Mizoram and Manipur, tree beans (*Parkia roxburghii*) are very popular. A leguminous tree, it has attractive foliage and highly nutritive beans. It is easy to grow. There are many other trees and shrubs which provide vegetables but a kitchen garden is not complete if it does not have a clump of lemon grass used for tea in the cold climate, a plant of curry leaf (*Murraya koenigi*) for use of fragrant leaves in curries and a *tulsi* (*Ocimum sanctum*) plant. *Tulsi* plant is not merely for worship, but also for medicinal use. The juice or decoction of its leaves is used for coughs and sore throat. It is very difficult to preserve it in the hills. A plant of drumstick (*Moringa oleifera*) is also an essential part in the plains and is of frequent use. In the hills asparagus and rhubarb also deserve to enjoy a permanent place. The *Colocasia* (*arvi*) may also get a place for its leaves as well as tubers.

There are certain vegetable crops like potato, beans, peas, turnip, European radish and carrot which can tolerate acidity (pH 5.5-6.5). To reduce acidity where required, lime may be added as discussed earlier.

The leguminous vegetables such as beans, peas, and pulses require bacteria, called rhizobia for their best development. The rhizobia are specific for different crops and are now commercially available in many places. The use of rhizobia for leguminous crops is normally recommended at the rate of 10 g for 1 kg of seed but may be modified according to the specific recommendation. Alternatively, soil from the place where such healthy crops have been grown earlier may be used.

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To facilitate sprouting earlier, seeds of leguminous vegetables, *bhindi* and *dhania* may be soaked in water for 12-24 hours before planting out in the garden.

For runner vegetables like peas and climbing beans, dig about 2-3 spit deep, i.e. about 37-67 cm ($1\frac{1}{2}$ – $2\frac{1}{2}$ ft). For bigger root vegetables, like sub-tropical carrot and radish, dig about half this depth. Fill the bottom with well-rotted manure and top with rich loam mixed with manure and fertilizers. The roots are attracted by the manure at the bottom and large root system is stimulated. For growing for exhibition purpose, spacing should be more. Thinning is required for developing bigger roots. Fresh manure should be avoided in growing root crops. It may result in coarse crop or in splitting of roots.

Some of the vegetables like pumpkin, vegetable marrow, cucumber, cauliflower and cabbage, are gross feeders and, therefore, their requirement of manure is high. For all root crops, potash either in chemical form or in the form of wood-ash is helpful. Phosphorus is helpful for all pod and flower crops like beans and cauliflowers.

In the plains, all root, stem and tuberous/bulbous vegetables do better if grown in trenches. In the hills, celery and leek are grown in trenches. Therefore, the kind of beds required for vegetables would differ, according to their requirement.

Earthing up of some of the vegetables which have a number of surface roots is required to protect tubers like potatoes, or to give stability to plants like maize or to stimulate growth of surface roots as for vegetables of the cabbage and beans family. It also conserves moisture.

Immediately after planting, cover with straw the seeds like peas, beans, maize, groundnuts to which birds or mice are very partial. Remove the straw immediately after germination of the seed and cover with small bushy sticks.

For sophisticated cultivation of plants which are heavy feeders, like vegetable marrows, pumpkins, cucumbers, squash or melons, earthen pots 10-12 cm (4-5 in.) in diameter with tiny holes to provide water-drip, may be fixed at soil level by the side of plants to enable water to reach the roots. This is particularly helpful in conditions of water scarcity. It will reduce loss due to evaporation and leaching.

Liquid manure is helpful when flower buds or pods are forming or roots or stems are thickening. Vegetables grown for their leaves, may be given liquid manure when crops are half-grown. Mulching with lawn-mowings, semi-decayed leaves or straw is helpful for vegetables in summer, as for flowers.

The runner vegetables, like French beans and peas, develop a large number of leaves at the centre and hide the flowers. Cutting out unnecessary leaves allows free circulation of air and light and helps in better setting of flowers. Fruits of a trailing plant should not drag the plant. If they touch the ground, a covering of straw underneath would prevent them from rotting or from uneven ripeness. Each fruit may even be lifted up on an inverted pot. This will save them from slugs also.

Staking of trailing plants with heavy fruits, staking of runners like beans and peas, and of bushes with heavy load of fruits like tomatoes, will need attention. If plants climb

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over a fence, enclose each fruit in a piece of net and tie it to the stake.

It is advisable to gather vegetables and fruits in the early morning or evening as there is more juice at that time and they are more succulent.

Vegetables should be collected when they are tender and succulent instead of allowing them to become big in size and fibrous. This is particularly so about the 'global' root crops which tend to become fibrous quickly, like beetroot, radish and turnip; knol-khol also has this tendency. Beans should be collected when they snap clean into two when divided with fingers.

Continuous uniform growth of vegetables would prevent them from their usual irregularities, for example bolting of cauliflowers or celery. It would also help in the development of rich colour and tender texture in the root crops.

CLASSIFICATION OF VEGETABLES

The vegetables can be broadly classified into the following groups and for purpose of crop rotation can be interchanged within the group:

Leafy vegetables. Amaranth, lettuce, *methi* (fenugreek), mint, *palak*, parsley, spinach.

Bulbous vegetables. Cho-cho, colocasia, onion, garlic, ginger, turmeric, leek, potato, sweet potato.

Cabbage family vegetables. Though this group falls under leaf crop, it has been shown separately as its requirement materially differs from others. It includes broccoli, Brussels sprouts, cabbage, cauliflower, kale, knol-khol.

Cucurbits. Cucumber, gourds, pumpkin, vegetable marrow.

Pod crops. Beans, cowpeas, blackgram, peas.

Root crops. Beetroot, carrot, parsnip, radish, turnip.

Stem crops. Asparagus, celery, rhubarb, sea kale.

VEGETABLES IN DIFFERENT SEASONS

In the north-western plains with extremes of cold and heat, there is a specific group of vegetables in each of the seasons – summer, rainy and winter. With a few exceptions, the vegetables for the rainy season can be grown in the summer with irrigation. In the southern plains, the vegetables suitable for summer and rains in the north-western plains can grow almost throughout the year. In the hills, which get snow-bound in winter, most of the vegetables would grow in summer. In the hills which do not get snowbound in winter almost all the vegetables can be grown in summer. But in winter, summer and rainy season vegetables of the plains would not grow. If there is heavy rain during the summer, carrots and other root vegetables and peas are grown in winter only. In the north-western plains, the summer vegetables are sown in February-

VEGETABLES – A KITCHEN GARDEN

March, the rainy season vegetables are generally sown in June-July and the winter vegetables in October-November. The summer vegetables would include the following:

- (i) Beans such as cluster beans, cowpeas and *Dolichos lablab*.
- (ii) Cucurbits such as cucumber, gourds, pumpkin and vegetable marrows.
- (iii) Leafy vegetables such as amaranth (*chaulai*), *kulfa* (*Portulaca oleracea*) and *palak*.
- (iv) *Okra*, pungent chillies, maize, tapioca, sweet potato.
- (v) Muskmelon and watermelon.

The rainy season vegetables will include all the summer vegetables described in (i) to (iv) above and *Colocasia* (*arvi*), French beans (bush type) and radish. The winter vegetables would include beans such as French beans, broad beans and peas; leafy vegetables such as spinach, *palak* and fenugreek; cabbage family vegetables such as cabbage, cauliflower and knol-khol, root vegetables such as carrot, radish and beetroot, herbs such as coriander and fennel (*saunf*) and others such as celery, non-pungent chillies, lettuce, tomatoes, asparagus and cho-cho.

As mentioned earlier, most of the vegetables are grown from seed. *Asparagus*, *Colocasia* (*arvi*), cho-cho, potato, sweet potato, *parwal* (pointed gourd) and tapioca are grown from tubers/ rhizomes/ stems. Deep tap-root plants like beans, and peas, cucurbits and okra or long root vegetables like carrots and radish are not transplanted. Cabbage family crops are generally transplanted. Lettuce is generally transplanted. A transplanted plant, having received a check, takes more time to mature. It is recommended by some that beetroot and turnips do better by *in situ* sowing. My experience in Shillong and Guwahati is that they do very well when transplanted and, therefore, we invariably adopted this practice for kitchen gardens. For commercial purposes, it may be advisable to sow seed *in situ* to avoid damage in large-scale transplantation.

LAYOUTS OF KITCHEN GARDENS

A layout of a good kitchen garden of the size of about 25 m² (250 ft²) is as follows:

| Vegetables | (ft ²) | Fruits | (ft ²) |
|-------------------------------|---|-----------------------------|---|
| Curry leaf | $2\frac{1}{2} \times 5 = 12\frac{1}{2}$ | Lime/Lemon | $6 \times 5 = 30$ |
| 2 compost pits | $3 \times 5 \times 2 = 30$ | Grapes | $4 \times 5 = 20$ |
| Coriander/Parsley | $3 \times 2\frac{1}{2} = 7\frac{1}{2}$ | 'Beauty Seedless'/Pineapple | |
| Mint | $3 \times 2\frac{1}{2} = 7\frac{1}{2}$ | <i>Karonda</i> | $2\frac{1}{2} \times 5 = 12\frac{1}{2}$ |
| <i>Tulsi</i> and lemon grass | $3 \times 2\frac{1}{2} = 7\frac{1}{2}$ | Peach/Papaya/Banana | |
| Chilli/Colocasia | $3 \times 2\frac{1}{2} = 7\frac{1}{2}$ | Arecanut | $6 \times 5 = 30$ |
| Radish ('Scarlet Globe') | $3 \times 5 = 15$ | | |
| Lettuce/Cucumber | $4 \times 5 = 20$ | | |
| <i>Palak</i> /Spinach/Tapioca | $4 \times 5 = 20$ | | |
| | $127\frac{1}{2}$ | | $92\frac{1}{2}$ |

Note: Mark the uniform width proposed for the vegetable beds. The fruits may be in separate pits but for the sake of facility a uniform width has been shown for them also.

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The total area for vegetables and fruits thus is 25 m² (250 ft²). The rest of the space may be required for circulation, bunds, etc. On the bunds, turnips, small radish or herbs can grow very well. A banana may be added in place of papaya/peach or in addition to them depending on the location and preference. There is not much scope for vegetable rotation in this design due to limitation of the size.

Another design has been attempted below for a garden of 120 m² (1,200 ft²) area which may be divided as follows:

| | |
|-----------------|-------|
| Lawn and hedges | 300 |
| Perennials | 150 |
| Annuals | 100 |
| Paths, etc. | 150 |
| Vegetables | 200 |
| Fruits | 300 |
| | 1,200 |

The kitchen garden of 50 m² (500 ft²) comprising fruits and vegetables may be further divided as follows:

For the plains

| Vegetables | (ft ²) | Fruits | (ft ²) |
|--|---|---|--|
| Curry leaf | $2\frac{1}{2} \times 5 = 12\frac{1}{2}$ | | |
| Compost pits (2) | $3 \times 5 \times 2 = 30$ | | |
| Coriander/Parsley | $3 \times 2\frac{1}{2} = 7\frac{1}{2}$ | Lemon/Lime | $6 \times 5 = 30$ |
| Tulsi and lemon grass | $3 \times 2\frac{1}{2} = 7\frac{1}{2}$ | | |
| Mint | $3 \times 2\frac{1}{2} = 7\frac{1}{2}$ | Drumstick | $2\frac{1}{2} \times 5 = 12\frac{1}{2}$ |
| Chilli/Colocasia | $3 \times 2\frac{1}{2} = 7\frac{1}{2}$ | Karonda(2) | $2\frac{1}{2} \times 5 \times 2 = 25$ |
| Radish ('Scarlet') | $3 \times 5 = 15$ | Grape 'Beauty Seedless' | $4 \times 5 = 20$ |
| Palak/Spinach | $4 \times 5 = 20$ | Grape | $8 \times 5 = 40$ |
| or | | | |
| Tapioca/Artichoke/ Amorphophallus seasonal vegetables 3 groups | $7 \times 5 \times 3 = 105$ | Strawberry/Papaya/ Guava/Dwarf mango Peach(2) or Custard apple and and mulberry Banana(2) (One table and one cooking) Phalsa (2) | $6 \times 5 \times 2 = 60$ $4 \times 5 \times 2 = 40$ $4 \times 5 \times 2 = 40$ |
| | 212 $\frac{1}{2}$ | | 297 $\frac{1}{2}$ |

Note: In coastal regions, replace grapes and peaches by coconuts and arecanuts.



122. Winged beans, a future food.

123. Brinjal 'Pusa
Purple Round'



124. Muskmelon, 'Sharbati'





125. Watermelon

126. Peas, 'Early Badger'





127. Radish, 'Japanese White'

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For the hills

| Vegetables | (ft ²) | Fruits | (ft ²) |
|---------------------------------|---|-----------------------------|------------------------------|
| Curry leaf | $2\frac{1}{2} \times 5 = 12\frac{1}{2}$ | | |
| Compost pits(2) | $3 \times 5 \times 2 = 30$ | | |
| Coriander/Parsley | $3 \times 2\frac{1}{2} = 7\frac{1}{2}$ | Lemon | $6 \times 5 = 30$ |
| Mint | $3 \times 2\frac{1}{2} = 7\frac{1}{2}$ | Tree tomato | $3 \times 5 = 15$ |
| Chilli/Colocasia | $3 \times 2\frac{1}{2} = 7\frac{1}{2}$ | Strawberries (2 beds) | $10 \times 5 \times 2 = 100$ |
| Radish (2 plots by rotation) | $3 \times 5 = 15$ | Gooseberries (10 bushes) | $7 \times 5 = 35$ |
| Spinach and lemon grass | $3 \times 5 = 15$ | Peach(2) | $7 \times 5 \times 2 = 70$ |
| Asparagus | $4 \times 5 = 20$ | Plum(2) | $8 \times 5 \times 2 = 80$ |
| Rhubarb | $3 \times 2\frac{1}{2} = 7\frac{1}{2}$ | Apple | $10 \times 5 = 50$ |
| Seasonal vegetables | $6 \times 5 \times 3 = 90$ | | |
| | $212\frac{1}{2}$ | | $287\frac{1}{2}$ |

The three plots mentioned in the tables above may be utilised for the three seasons, viz. summer, rainy and winter as follows:

| Summer | Rains | Winter |
|---------------------|--------------------------------|------------------------------------|
| 1. Beans | 1. Okra | 1. Carrots/Beetroot/Turnips/Onions |
| 2. Cucurbits | 2. Sweet potato/ Leafy veg. | 2. Peas/Beans |
| 3. Maize/Leafy veg. | 3. Beans | 3. Cauliflower/Cabbage/Potato |

The plot No. 1 may move against serial No. 1 from summer to rains to winter as shown above and thereafter may move on to the vegetables shown against plot No. 2 starting with summer. Similarly, plot No. 2 and 3 after completing the cycle of vegetables in summer, rains and winter may move on to the vegetables respectively of plots No. 3 and 1.

COMMON VEGETABLES

For the sake of facility of reference, the vegetables have been described in their alphabetical order and according to their groups. Time given is from the date of sowing seed or planting a cutting and not from transplanting. The time schedule given here for the plains is more appropriate for the north-west Indian plains. The time schedule for the hills is also better applicable for the northern hills not snow bound in winter. It can be earlier by a month for the southern hills for summer sowing and can be extended by the same period for winter sowing.

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AMARANTH

[*Amaranthus tricolor*, (*Badi chaulai*); *A. blitum* (*Chhoti chaulai*)]

A leafy vegetable cooked and consumed like spinach. There are many varieties with tender leaves, green or red in colour. Green is more common than the red one. Easy to grow. Can grow up to 1,500 m. Generally sown *in situ*, though the *badi chaulai* is transplanted also. Grows abundantly by itself in the beds from the seeds fallen from the last season.

| | Plains | Hills |
|------------------|---|---------------------------|
| Sowing | Throughout the year except severe winter months | Spring and summer |
| Harvesting | 30-45 days for 2-3 months | 45-60 days for 2-3 months |
| Spacing | Between plants 20-25 cm (8-10 in.) and between rows 30 cm (12 in.) for the bigger variety and about 2/3rd of this spacing for the smaller one | |
| Seed requirement | 5 g for 10m ² | |
| Varieties | <i>Badi chaulai</i> <i>Chhoti chaulai</i> | |

ARUM

(*Colocasia esculenta*; Hindi: *Arvi*, *Ghayan*)

Arvi is popular both for its corms as also for its edible tender leaves after boiling. Boiled corms fried and mixed with curd, salt and pepper is a favourite dish during the days of fasting. The corms are used for chips also. The edible leaves after boiling, fried like 'pakoras' is a popular dish. The variety with dark purple-green leaves, is less irritating to the throat than the one with dark green leaves. Corms are easily available in the market, but tender leaves of good quality are difficult to get commercially. Hence, the housewife may prefer to have a few plants of *arvi* in her own garden.

Corms thrive in hot and moist climate and are cultivated in the rainy season or in summer with irrigation.

| | Plains | Hills |
|------------------|--|------------------|
| Sowing | February-March, June-July | March-May |
| Harvesting | After 3½–4½ months | After 4-5 months |
| Spacing | 20 cm (8 in.) between tubers and 40 cm (16 in.) between rows | |
| Seed requirement | One kg of <i>arvi</i> will contain about thirty corms. | |
| Varieties | 'C-99', 'C-266', Khasi Bhungha,' | |

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ASPARAGUS

(*Asparagus officinalis*; Hindi: *Halyun*)

It is a perennial stem crop belonging to the family of lilies. The tender part of its stem known as spear or 'top' is blanched and used as a delicacy for soups. The asparagus tops are also used as '*hors d'oeuvre*'. It grows well in the hills only. It can be prepared from seed sown in March and transplanted after about a month. This would take about two years to be ready. The period can be reduced by using asparagus crowns, if available. Plant the crowns 10 cm deep in March-April. Saddle planting of the crowns is helpful. Stems will be ready in May-June a year afterwards. Cut sparingly in the first season to allow the plant to become stronger. Cut shoots back and cover with a thick mulch of manure in autumn. New shoots appear in next April-May. It is recommended by some that no cuttings should be taken after June-July. I, however, consider that given proper pruning, sufficient rest and manure from October to March, the cuttings of shoots may be continued till fresh tender shoots appear, which may be up to September-October.

The beds should be raised by about 15 cm. Earth up the stems. Blanched stems only can be used; green ones are bitter in taste.

The land will get permanently blocked under this crop and, therefore, a small area only may be allotted to it, so as not to disturb it. The life of a plant in the hills is about 8-10 years. In the plains it may be less. The site may be changed thereafter, and new crowns planted a year before uprooting the old crop.

At present only tinned asparagus is available and there is a cry of joy at asparagus soup with cream or asparagus spread for sandwiches. Fresh asparagus is more tasty and better flavoured. This crop needs to be popularized more. Asparagus should be consumed immediately after harvesting as it fast loses in quality.

| | |
|------------|---|
| Sowing | March-April |
| Harvesting | May-September |
| Spacing | 30 cm (12 in.) between plants and rows |
| Varieties | 'Perfection' recommended by Indian Agricultural Research Institute. |

BEANS AND PEAS FAMILY

FRENCH BEANS

(*Phaseolus vulgaris*; Hindi: *Vilaiti sem*)

This is the most popular of the beans. There are two types — bush and pole. They are sensitive to cold and wet weather. Pole beans are more prolific (about 25 — 30 per cent more) and give fruit over a longer period than the bush type, but are more delicate. The bush varieties are comparatively early.

Bush French beans are only 40-45 cm (16-18 in.) tall but roots are very deep. It is a

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mistake to believe that they can do without plenty of food. They are also gross feeders though not as much as the pole ones. The pole beans are as tall as $1-1\frac{1}{2}$ m (4-5 ft) but do not do well in the plains.

Stake pole beans with small bushy sticks initially supplemented by strong sticks later. Earth up stem when about 20 cm (8 in.) tall. Keep the centre of the plant clear of unnecessary leaves to allow air and light.

French beans are prone to drop their blossom or first buds. Most probably this is due to high temperature range under which it does not set fruit. It may also sometimes be due to excessive dampness. During first flowering days it is advisable to be more careful about watering or drainage of excess moisture. Flower dropping generally stops after pods start forming freely. Spraying with plain water is helpful on a very dry day or if flowers drop in the middle of the season. The crop is shallow rooted and is very susceptible to water-logging conditions which causes yellowing of leaves.

It is believed that beans require a kind of bacteria in the soil for best development. The bacteria increase if the same ground is used over a number of years and this gives a better yield of beans. I am not sure of this and have not adopted it. In fact, I have tried to change the plot every year.

| | Plains | Hills |
|------------|---|--|
| Sowing | August-October | March-July |
| Harvesting | 45-60 days (bush) 70-90 days (runner) | 2-3 months (bush) 3-4 months (runner) |
| Spacing | 45-60 cm ($1\frac{1}{2}$ -2 ft) for bush. For runners, sow in rows of double drill 20-30 cm (8-12 in.) between each plant and a row with 60 cm (2 ft) between each double drill. | |
| Seed rate | For runner, 25 g for 10 m ² (1 oz. for 100 ft ²). The seed requirement of bush type may be double that of runners. | |
| Varieties | Bush type: 'Contender', 'Green-podded', 'Premier', 'Pusa Parvati'; Runner type: 'Kentucky Wonder'. | |

Note: 'Contender' is reported to be tolerant to mosaic and powdery mildew. There are many local runner-type varieties available in the north-east. Some of them are called 'Manipuri'.

BROAD BEANS (*Vicia faba*; Hindi: *Bakla*)

Broad beans are broad-podded or long-podded. They are cooked when green and tender and also used as pulses when dry. The broad-podded varieties do well in the hills only.

Just before flowering the plant which is of branching habit throws out basal side shoots. Remove these and train it to a single stake.

VEGETABLES – A KITCHEN GARDEN

Pinch off the growing point immediately after the plant finishes blooming. This will concentrate nutrients in the developing beans and will also check attack from black fly. Black fly favours the blooms for laying its eggs.

Collect broad beans to be used as green when only slight swelling shows in the skin.

| | Plains | Hills |
|-----------------------|----------------------------------|------------|
| Sowing | October-November | March-June |
| Harvesing | 3 months | 4 months |
| Spacing and seed rate | As for runner French beans | |
| Varieties | No recognised improved varieties | |

LABLAB

(*Lablab purpureus*; Hindi: *Sem*)

It is one of the most popular beans. It is very easy to grow and is not fussy about soil or climate conditions. Like French beans, there are two types of these beans also, bush and runner. Its vigorous vine trained on a trellis can become an excellent screen. There are many varieties with broad or narrow, green, whitish-green or purple tinted pods and pink or white flowers. It can be cooked as a vegetable when green and as a pulse when ripe. Seeds are brown-red, black, speckled, orange-yellow, etc. The varieties with narrow pods are more tender and tasty as green vegetable, than those with broad pods. The varieties of whitish-green colour are still superior.

The vine is of vigorous growth and, therefore, should be raised on bowers, pergolas or strong trellis. It can be successfully grown in the hills also.

| | Plains | Hills |
|------------|---|------------|
| Sowing | July-August | March-June |
| Harvesting | From November to March | |
| Spacing | Pits 60 cm × 60 cm (2 ft × 2 ft) size and about 1½ m (5-6 ft) apart with 3 seeds in a pit | |
| Seed rate | As for French beans. | |
| Vatieties | 'Pusa Early Prolific' | |

COWPEA

(*Vigna unguiculata*; Hindi: *Lobia*)

This is also a popular bean, also known as *Asparagus* bean. Cultivation is similar to

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that of *Lablab purpureus*. There are varieties of dark green, light green and whitish-green colour. The seeds are of cream colour with or without a black eye. The dark green varieties are the most superior as green pods. There are a few varieties which grow well on the hills also. Does better in the plains.

| | Plains | Hills |
|------------|---|---------------------------------|
| Sowing | February-March to July-August | March-May |
| Harvesting | After 60 days for 2-3 months | After 75-90 days for 2-3 months |
| Spacing | As for <i>Lablab purpureus</i> | |
| Seed rate | —do— | |
| Varieties | 'Pusa Phalguni' (Spring-summer season); 'Pusa Barsati' (Rainy season); 'Pusa Do-fasli' (Both seasons). Selection 1552 (IARI) bush type (summer and rains) is reported to be resistant to bacterial blight. | |

BEETROOT

(*Beta vulgaris*; Hindi: *Chukandar*)

It is a root vegetable used mainly as salad. In combination with tamarind or ground *anardana* (dried pomegranate seed), it makes a delicious cooked vegetable also. It can be used for making 'halwa' similar to carrot 'halwa', and also for pickles. Roots should be collected before they become fibrous. A good size is that of a golf ball. Can be grown by transplanting or sown *in situ*. Young seedlings should be protected from sparrows.

Cultivation of beetroot is similar to that of carrots. It thrives better in cooler climate and, therefore, in the plains it can be cultivated in winter only.

Beetroot, if pressed, 'bleeds' and requires careful handling. When picking the roots, leaves should be twisted with hand and thus broken off rather than cut with knife. The latter process increases bleeding. Bleeding of a bruised beetroot when boiled can be reduced, if a little vinegar is added to the boiling water.

The seed of beetroot, which resemble the seed of *palak*, cannot be raised in the plains.

| | Plains | Hills |
|------------|---|-------------|
| Sowing | September-December | March-June |
| Harvesting | 2-3 months | 3-3½ months |
| Distance | Between plants 15 cm (6 in.) and between rows 30 cm (12 in.) | |
| Seed rate | 1 g/m ² | |
| Varieties | Early: 'Crosby's Egyptian', 'Early Wonder' Late: 'Detroit Dark Red', 'Crimson Globe' | |

VEGETABLES — A KITCHEN GARDEN

BRINJAL

(*Solanum melongena*; Hindi: *Baingan*)

It is a warm season crop susceptible to frost. It is a very popular vegetable widely cultivated. It is said that consumption of this vegetable in February-March serves as a preventive to children against measles. It makes good pickles also. There are several varieties with different sizes, colours and shapes. There are dark, purple, shining round and long ones, there are lovely green ones and there are white ones which are very attractive but their skin is not so tender.

Brinjal can be grown throughout the year in the plains, except for the severe winter months. They can be grown successfully in the hills at least up to 1,500 m (5,000 ft) during summer.

It is recommended that shoots of the plant, after first flush of fruits is over, should be cut back to promote new growth. It will give another crop of fruits. Earth up the plant when about 30-40 cm (12-16 in).

| | Plains | Hills |
|------------|---|------------|
| Sowing | 3 sowings: February-March June-July October-November | March-May |
| Harvesting | 3-4 months | 4-5 months |
| Spacing | 30-45 cm (12-18 in.) between plants and about 60 cm (2 ft) between rows. | |
| Seed rate | 2-5 g/10m ² (4-6 oz/acre). | |
| Varieties | 'Annamalai' (purple long), 'Arka Navneet', 'Arka Sheel', 'Arka Shirish', 'Arka Kusumakar', 'Pusa Kranti', 'Pusa Purple Cluster', 'Pusa Purple Long'. It is reported that these varieties have done well in the hills also. They have been reported to do equally well in the North and South India. 'Annamalai' is reported to be resistant to aphids and tolerant to wilt. | |

CABBAGE FAMILY

Cabbage family includes cabbage, cauliflower, knol-khol, Brussels sprouts, broccoli, sea kale, etc. but in India the most widely grown are cabbage, cauliflower and knol-khol. In the plains, these vegetables are grown in winter. In the hills, they can be grown throughout the year, but cauliflower prefers comparatively cooler period and therefore does better in winter. Cauliflower, being less hardy than cabbage, is also more susceptible to heavy frost.

'Bolting' i.e., premature seed formation, without formation of heads or 'Buttoning' formation of a button head, are common troubles. The trouble starts when the plant becomes long jointed instead of retaining the normal rosette character. The chief cause of bolting is defective seed or planting in the wrong season. Plants which run into warm

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weather as they are planted too early or too late show greater tendency to bolting. Buttoning may happen due to shock or check to the plant during its growth. It may be due to a dry spell, lack of nutrition, exposure to serious disease, etc. Good seed, proper season, cool and moist atmosphere around the vegetables will give them a firm head and keep the 'bolting' and 'buttoning' away.

The plants are generally transplanted. Plants should be earthed up so as to form good surface growth.

Vegetables of cabbage family are susceptible to black rot and soft rot diseases.

CABBAGE

(*Brassica oleracea* var. *capitata*; Hindi: *Banajabhi*)

There are several varieties differing in size, shape and colour — conical, globular, pale green like 'Golden Acre' or 'Drumhead' and purple red as of red cabbage, small like 'Golden Acre' and huge like 'Drumhead'. There are early and late varieties.

The 'Drumhead' variety is unequalled in size and taste. It can easily weigh even with ordinary culture as much as 2 kg. It is a late variety. Red varieties are not so tasty. They can be used for pickles or for decorative purposes. A bed of these red cabbages with their purple-red, glaucous foliage is a beautiful sight. For household purposes 'Golden Acre' which would weigh between $\frac{1}{2}$ and 1 kg is a good choice. After the main vegetable head is collected, if the plant is left on the ground with bottom leaves intact, it gives 2-3 small vegetable heads. Cabbage does not produce seed in the plains in India. Elevation from 900 m to 2,200 m (3,000-7,000 ft) is required for seed formation. For pure seed, distance of about one mile is required from other cole crops to prevent cross-pollination.

Cabbage is a heavy feeder. Soil should be rich from the beginning. Liquid manure is helpful when the plant is well established.

| | Plains | Hills |
|------------|---|--|
| Sowing | Early: August-September Main: October-November | March-August |
| Harvesting | Early: 60-80 days Main: 80-100 days | Early: 80-100 days Main: 100-120 days |
| Spacing | 37 cm (15 in.) between plants and 60 cm (2 ft) between rows for early varieties. 45-60 cm (18-24 in.) between plants and 60-90 cm (2-3 ft) between rows for main crop varieties. | |
| Seed rate | 1 g per m ² (8-12 oz per acre) | |
| Varieties | Early: 'Golden Acre' Main crop: 'Drumhead'. | |

VEGETABLES – A KITCHEN GARDEN

CARROT

(*Daucus carota*; Hindi: *Gajar*)

Carrot is one of the most popular salad vegetables. It is an excellent cooked vegetable, and popular for pickles also. Grated and cooked with milk, sugar and 'ghee' (fat), its 'halwa' is a delicacy of North India, which has gained popularity in the South also. Black carrots (in combination with salt and *rai*) make a deliciously cool drink, known as *kanji*.

There are several varieties, differing in colour, texture, shape and length. They can be divided into sub-tropical and temperate varieties. Sub-tropical are sometimes referred to as Asiatic. The temperate varieties need chilling and rest period of about a fortnight before flowering. The varieties are orange. Small rooted about 10-15 cm (4-6 in.) and the varieties suitable for home gardens are intermediate, well-grown ones about 22 cm (9 in.). Short varieties are also suitable for intercropping.

Seeds of sub-tropical varieties can be raised in the plains while those of the temperate varieties can be raised only in the hills.

Direct sowing on ridges is better than on the flat beds. The growth of roots is not checked in such a method and they do not form side roots. If sown on the flat beds, the soil should be light and kept well loosened and the plant should be earthed up. Soil to be loosened may be about one-and-a-half times the expected length. Break the soil fine to avoid any obstruction to the root.

Planted at fortnightly intervals; it will provide supply for 3-4 months. Draw first roots when about the thickness of a finger. Roots form ugly shape if any recently manured plot is used. Preferably, the plot manured from the last crop should be used. Do not hurry with actual thinning. Carrot seedlings being thin, do not overcrowd as quickly as others. Do not do all thinning at one time; it can be divided in groups of four plants and one of each group may be thinned at a time. Firm the displaced soil after each thinning. Give liquid manure after thinning.

Too fast developing roots, push out an inch or so above the ground and the uncovered portion becomes green and unusable. Earth up these roots immediately; this may be necessary 2-3 times during the season. Cut the leaves of carrot flush with the crown; otherwise the flavour may be spoiled as the growing point which is lower may continue to grow for some time.

| | Plains | Hills |
|------------|---|--|
| Sowing | Sub-tropical: August-October Temperate: October-December | In the hills with heavy rainfall, which do not have snow in winter, carrot is usually grown as a winter crop from October to December. In other hills it may be grown as a summer crop from March to June. |
| Harvesting | Early: 60-80 days Main: 80-100 days | |

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| | |
|-----------|---|
| Spacing | 15-20 cm (6-8 in.) between plants and 20 cm (8 in.) between rows |
| Seed rate | 1/2 g per m ² |
| Varieties | Sub-tropical: 'Pusa Kesar', 'Pusa Meghali' Temperate Early: 'Early Gem', 'Early Scarlet Orange', 'Nantes Half Long', 'Pusa Jandagni' Main: 'Favourite', 'Perfection', 'Chantaney', 'Coreless', 'Imperator' |

CAULIFLOWER

(*Brassica oleracea* var. *botrytis*; Hindi: *Phulgobhi*)

Cultivation as for cabbage. Earth up the plant when about 20 cm (8 in.). Early varieties of cauliflower form seeds in the plains. In late varieties the seed formation is only in the hills. When heads begin to form, a couple of leaves at the bottom can be bent or tied and brought over the head. This will blanch the head and keep it white. The stalk left in the ground after cutting the vegetable head develops side growth. It can be detached and cultivated as cuttings and excellent cauliflowers can be grown weighing 1 $\frac{1}{2}$ —2 kg each. This can be practised only in the hills and also takes a very long time to grow, almost one whole year. Due to its long period, it is not a recommended practice. Cauliflower may also have the trouble of 'bolting' and 'buttoning' as for the cabbage. The preventive measures are the same.

| | Plains | Hills |
|-----------------------|---|----------------|
| Sowing | Early: June-July with protection from direct sunshine Main: September-October | As for cabbage |
| Harvesting | Early: 90-100 days Main: 120-140 days | |
| Spacing and seed rate | As for cabbage | |
| Varieties | Early: 'Pusa Katki', 'Patna', 'Faizabadi' Main: 'Pusa Deepti', 'Pusa Synthetic', 'Improved Japanese' Late: 'Pusa Snowball-1', 'Pusa Snowball-2' | |

Note: In the Khasi Hills (Meghalaya), there are local long-duration varieties which take 5 $\frac{1}{2}$ -6 $\frac{1}{2}$ months. Not much susceptible to diseases. Very big heads, 2 $\frac{1}{2}$ kg or even more.

CELERY

(*Apium graveolens*; Hindi: *Ajmud*)

Celery is a delicacy for soups and salads. Its stem is mainly used, but for the off season, people like to dry the leaves and use in the soup as a flavouring. It is a winter crop for the plains; it is also taken as a winter crop in the hills where there is no snowfall.

VEGETABLES — A KITCHEN GARDEN

It is transplanted in trenches in a sunny position. North to south rows are ideal. Trenches should be dug deep about 40 cm (15 in.) and should be about 45 cm (18 in.) wide. When plants are about 20 cm (8 in.), they are ready for first earthing up. Remove all leaves from around the base. Plants with markedly sunken growing points or outwardly spreading leaf stalks should be rejected as they are prone to give perpetual branches and not a good length of stem. Also reject a long-jointed drawn-up plant as it is likely to bolt.

Add a handful of leaf mould in the soil at the bottom of each plant. Take care just to bury the roots in the soil. Deep planting is a fatal blunder as this will rot the plant. Drought conditions after planting may cause bolting.

Object of earthing up is to blanch the stem. Before earthing up, remove the leaves underneath as they would rot inside. Remove side shoots as they are against lengthening of the stem. Tie up after first earthing up with a loose knot. As the growth continues, earth up at fortnightly intervals.

Sometime root rot takes place.

Remove the susceptible plants and spread slaked lime water @ 5 litres per metre run (one gallon per yard) at fortnightly intervals until the last earthing up. Lime water may be made by adding about 100 g slaked lime in 15 litres of water (1 oz lime for 1 gallon water).

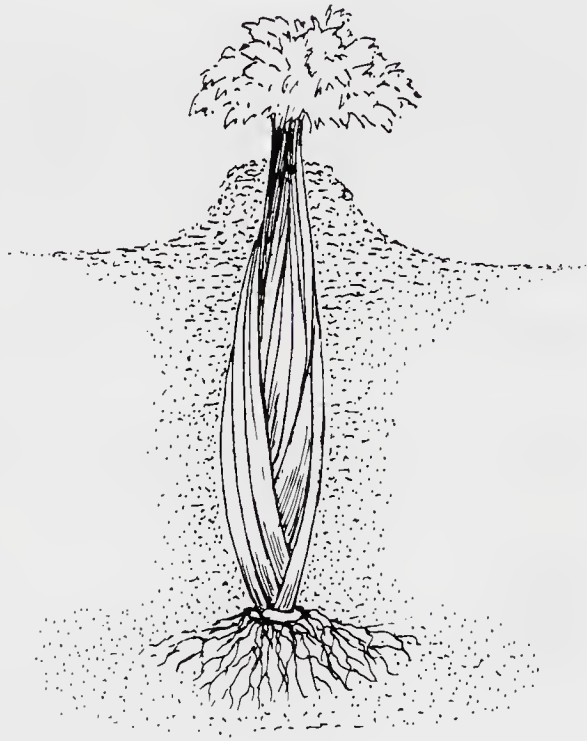


Fig. 19. Trenching of vegetables as in celery.

| | Plains | Hills |
|------------|---|-------------------------------------|
| Sowing | August-October | February-April September-October |
| Harvesting | 5-6 months | |
| Distance | Should be sown in 45 cm (18 in.) wide trenches in a double row, space being 22 cm (9 in.) between the plants. For a show, sow in 30 cm (12 in.) trenches in a single row, 60 cm (2 ft) between trenches and 30 cm (1 ft) between the plant. | |
| Seed rate | 1 to 1.5 g for 100 m ² | |
| Varieties | No recognised variety in India | |

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CHILLI

(*Capsicum annuum* var. *acuminatum*; Hindi: *Lalmirch*)

Pungent chilli, as a spice, is very popular in India. The non-pungent varieties are generally cultivated in the hills and regarded as a delicacy. These non-pungent varieties known locally as *Simla mirch* are successfully grown in the north Indian plains in winter. Stuffed with boiled potatoes, they are a popular dish. For those afraid of pungent chillies, these can be used as a flavouring. There is another group of non-pungent to mildly pungent varieties like 'Hungarian Wax'. These are long fleshy types, which make excellent *pakor*s or pickles.

The plants are generally transplanted. The non-pungent ones are delicate and susceptible to diseases.

| | Plains | Hills |
|------------|---|--------------------------|
| Sowing | September-November (Non-pungent varieties) June-July (Pungent varieties) | March-June |
| Harvesting | 2-2 $\frac{1}{2}$ months | 3-3 $\frac{1}{2}$ months |
| Distance | 30-45 cm (1-1 $\frac{1}{2}$ ft.) apart | |
| Seed rate | 1 g/ 10 m ² (1 lb/.acre) | |
| Varieties | Non-pungent: 'California Wonder', 'World Beater', 'Bull Nose', 'Chinese Giant', 'Yolo Wonder' Pungent: 'N.P. 46A' (for fresh consumption) 'G ₂ ', 'G ₃ ', 'G ₄ ' (for storage), 'Pusa Jwala', 'Pant C-1' | |

CHO-CHO

(*Sechium edule*; Hindi: *Launku*)

Cho-cho is a perennial vegetable of vine type, suitable for the hills. Its foliage dies in winter and reappears in March-April. In the Khasi and Jaintia Hills, it was locally known as squash, though squash is a different vegetable (*Cucurbita pepo*). It has very vigorous growth and has large tubers which when cooked taste like potato. Starts fruiting from end of July onwards and continues up to October-November until the heavy frost sets in. The plant should be well manured in March-April as soon as the new shoots appear. Propagation can be by tuber division or by the later fruits with aerial roots. A cho-cho if allowed on the plant long enough towards its maturity period in September-October, develops roots. If planted at that stage it develops into a healthy plant and fruits next year. Fruit is soft, spongy and tasty. It tastes like bottle-gourd. Can be used for similar preparations. The middle thin white portion of the fruit should be thrown away. A very valuable vegetable for the hills, its leaves, fruits and tubers — all are tasty.

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| | |
|------------|---|
| | Hills |
| Sowing | March-April or fruit as above. |
| Harvesting | July-October |
| Distance | Sown in pits 60 cm × 60 cm (2 ft × 2 ft) with a distance of 1-1½ m (4-6 ft) between the pits. Distance between large tubers may be 3-4 m (10-14 ft) |
| Yield | A vine may give as much as 100 kg, from a single plant in the hills. |
| Varieites | No recognized improved variety. |

CUCUMBER

(*Cucumis sativus*; Hindi: *Khira*)

Very popular vegetable for salad. It also makes an excellent curry vegetable when mature for seed. It grows throughout the country in the summer and during the whole year in the southern parts of the country. Cucumber should not be allowed to bear fruit on the main stem as this weakens the latter. Therefore, pinch off growing shoot and stop it as for bottle-gourds.

If plants refuse to start bearing it is said that pollinating 2-3 female flowers gives them bearing habit. The resulting bull-necked fruits may be thrown away. Nip off as many male flowers as convenient. The cucumbers sometime become bitter. This is due to overfeeding with liquid manure or violent check at some stage of its growth.

Another similar vegetable, though not so tasty is popularly known as 'kakri'. It belongs to the same species as that of musk-melon. Its botanic name is *Cucumis melo* var. *utilissimus*.

Cucumbers are generally sown in round pits at convenient places to let them trail on the house roofs, pergolas or bowers. Seed is sown direct.

| | | |
|------------|---|--|
| | Plains | Hills |
| Planting | February-March June-July October-December | March-June |
| Harvesting | Start giving fruits after 2-3 months for about 4-6 weeks | Start giving fruits after 3-4 months for about 4-6 weeks |
| Spacing | If cultivated in beds, between plants and rows 90 cm × 90 cm (3 ft × 3 ft). If sown in round pits 60 cm × 60 cm (2 ft × 2 ft) with 4 seeds each and 2 m (6 ft) apart from centre to centre. Seeds are later thinned to one or two. | |
| Varieties | 'Japanese Long Green', 'Poinsette', 'Straight Eight' | |

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FENNEL

(*Foeniculum officinale*; Hindi: *Saunf*)

The seeds of fennel are used as a spice. It is not a vegetable. Its brew is used for stomach ailments. It is propagated by seed sown in September-October. Its flower heads like those of Ladylace are delicately pretty and the seeds when tender are sweet and delicious. I always like to grow a few plants in the season. It is extremely popular with children. The seeds mature in March-April. Can be grown in any garden soil. Its height is about 45 cm (18 in.). The spacing may be 30 cm (12 in.).

FENUGREEK

(*Trigonella foenum-graecum*; Hindi: *Methi*)

Fenugreek is a very popular Indian herb. Its leaves are cooked as a green vegetable and seeds are used as a spice. It has a strong likeable scent. 'Kasturi methi' (*T. corniculata*) is famous for its scent. Its seed requirement is less and production is more than common fenugreek. Fenugreek has medicinal value for rheumatic and gout patients and stomach ailments. It is very quick growing and comes to the aid of organisers of special functions if any ground is to be covered quickly for green effect or any green lettering is required.

It is a winter crop and dislikes hot and moist climate. It grows well in the hills also. It can be cultivated as an intercrop with peas, cauliflower or cabbage, in succession at fortnightly intervals, throughout the winter.

| | |
|------------------|--|
| Sowing | October-March |
| Harvesting | After 3-4 weeks. Cuttings can be taken for 3-4 weeks |
| Seed requirement | 2 g/10 m ² |
| Varieties | 'Pusa Early Bunching', 'Kasturi methi' |

BITTER GOURD

(*Momordica charantia*; Hindi: *Karela*)

Karela belongs to the family of cucurbits. Its slender creeper trained on a trellis with dark green or greenish-white oval fruits with blunt tubercles tapering towards the end, like the shape of a 'gulli' in the native play of 'gulli and danda' makes an ornamental hedge. It is a summer and rainy season crop suited for the plains. There are small-fruited and large-fruited varieties.

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As the name bitter gourd itself suggests, it has bitter taste but if the fruit is mature and the process of cooking right, it makes one of the most delicious dishes. As the local proverb also goes, an unripe fruit is very bitter. After peeling off the tubercles, if the fruit is soaked in salted buttermilk for 4-6 hours, its bitterness is reduced. The vegetable is said to have medicinal properties, specially its juice for diabetes. When it rains, a Gujarati song remembers hot 'rotis' (flattened wheat cakes) with *karela* vegetable.

| | |
|------------------|---|
| Sowing | Plains |
| | February-March |
| | June-July |
| Harvesting | After $2\frac{1}{2}$ -3 months for about 6 weeks |
| Spacing | 45 cm × 45 cm (18 in. × 18 in.) pit about 1 m (3 ft) apart, with 3 seeds in a pit |
| Seed requirement | Twice that of cucumber |
| Varieties | 'Pusa Domosmi'. Suitable for summer and rainy season. In the South, 'Co. Long', , 'Pusa Vishes' and 'Arka Harit' are popular. |

M. dioica is a non-bitter species known as *bhat karela*. It has tubers; the leaves die in winter and come up again in February-March. Its male and female plants are separate.

BOTTLE-GOURD

(*Lagenaria siceraria*; Hindi: *Lauki*, *Ghia*, *Kaddu*)

It belongs to the cucurbit family. Bottle-gourd is a smooth, long, light green and almost cylindrical fruit with a curved neck without ridges. The round ones are equally attractive. They are almost globular tapering to a narrow shape to the point where it joins the vine, like a handle for wielding and otherwise too round an object. A creeper trailing over thatched huts in villages with bright glistening white blooms and tender fruits is a catching sight. It is an excellent soft vegetable with delicate flavour. It can be cooked as a vegetable, used for chops and 'koftas' or used for 'halwa'.

In the plains it can be cultivated throughout the year with the exception of the severe frost-prone months of December-January. In the hills it can be grown in spring and summer only.

Sow seeds *in situ* in pits. Fruit-feeding roots are near the surface; top-dressing, therefore is very helpful. Whether the roots show through or not, dress the surface with a 5 cm (2 in.) thick layer of fibrous loam and well-rotted manure in equal parts. Repeat this 2-3 times during a season. It requires abundant moisture all the time. Gourd stems throw out shoots wherever they touch the soil.

Pinch off growing point to induce branching. As each resulting shoot makes 6-8

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leaves, pinch off its growing point further. This will compel the formation of side shoots. Soon after side shoots appear, they will develop male and female flowers. The female ones have a little gourd beneath them. If the male flowers are plentiful, some of them can be removed.

As soon as gourds start swelling freely, 'stop' the shoots that bear them one leaf beyond the fruit. Continue this treatment right through the season as each successive batch of side shoots forms. Thus, a very fruitful and shapely plant develops. Best stage of eating is when the fruits have soft hairy appearance and you can push your finger nail through the skin or scrape it easily.

Some common troubles. (a) Immature gourds falling — a very usual trouble. Baby fruits remain at a standstill, eventually shrivel up and fall off. Usually, this is due to lack of sufficient nourishment or watering. Supply liquid manure and let it reach right down to the roots. (b) Small fruits rotting — gourds when quite small, turn yellow, rot at the end and eventually fall off. This may be due to water-logging or imperfect pollination.

| | | |
|------------------|--|-----------|
| | Plains | Hills |
| Sowing | February-March June-July | March-May |
| Harvesting | After $2\frac{1}{2}$ - 3 months onwards for about 6-8 weeks. | |
| Spacing | Direct seed sowing in pits 60 cm \times 60 cm (2 ft \times 2 ft) and 2 m (6 ft - 7 ft) apart. 3 seeds in a pit, later thinned to one or two | |
| Seed requirement | 5 g for 10 m ² | |
| Yield, varieties | One climber may give as many as 25-30 fruits. 'Pusa Summer Prolific' (Long), 'Pusa Meghdoot' (Long), 'Pusa Summer Prolific' (Round), 'Pusa Manjari' (Round), 'Pusa Naveen'. Some good local strains available in the Khasi Hills | |

SPONGE GOURD

(*Luffa cylindrica*; Hindi: *Chikni tori*)

RIDGE GOURD

(*Luffa acutangula*; Hindi: *Kali tori*)

It is popularly known as 'sponge gourd' because of its fibrous material when fruits are ripe. After removing seeds and shell, the sponge is used for bathing and cleaning utensils. Luffa gourd belongs to cucurbit family. Its vine carrying plenty of smooth dark green fruits with bright yellow flowers is very vigorous and looks attractive. Well established, it can give fruit over a long period of 3-4 months. The vegetable is soft and has special flavour. It is considered easily digestible and is, therefore, given to patients. The vegetable is popular with those who like its soft texture and flavour. It offers very limited preparations.

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It does not find favour with children. The cultivation is as for bottle-gourds.

There is another species which has ridges – *Luffa acutangula*. It is similar in habit of growth and its taste and texture is also similar but slightly inferior. It is, however, more hardy and can successfully grow up to 1,500 m (5,000 ft). *Luffa cylindrica* is reported to grow only up to 1,000 m (3,300 ft.)

| | |
|------------------------------|---|
| Sowing | February-March June-July |
| Harvesting | (2½-3 months) |
| Spacing and seed requirement | As for bottle-gourd |
| Varieties | ‘Pusa Chikni’ (Sponge gourd), ‘Pusa Nasdar’ (Ridge gourd) |

GROUNDNUT

(*Arachis hypogaea*; Hindi: *Mungphali*)

Tender pods of groundnut are a delight to eat like tender almonds besides helping in fixing nitrogen in the soil. I would like to give a small area for this crop in rainy season. It likes light soil. The plant should be well earthed up. For the hills also now there are varieties which set well and give good yield.

| | | |
|------------|--|-------------|
| | Plains | Hills |
| Sowing | June-July | March-April |
| Harvesting | 100 days | 4-5 months |
| Spacing | 30 cm (12 in.) between plants and 45 cm (18 in.) between rows | |
| Seed rate | 25 g/10 m ² | |

KNOL-KHOL

(*Brassica oleracea* var. *caulorapa*; Hindi: *Ganth gobi*)

The cultivation of knol-khol is as for turnips. It also combines their flavour. Knol-khol is popular as salad and also as cooked vegetable. Its tender leaves can be cooked as a leafy vegetable. Don't allow knobs to grow too large before lifting as they soon become coarse and fibrous. A good size is that of a cricket ball as at that stage it is tender and succulent. The transplanting as well as direct sowing are successful. Sowing on the ridges is preferable. As with the cabbage, seeds cannot be raised in the plains.

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| | Plains | Hills |
|------------|--|------------|
| Sowing | August-November | March-July |
| Harvesting | 2 $\frac{1}{2}$ months | 3-4 months |
| Spacing | 20 cm (8 in.) between plants and rows | |
| Varieties | 'White Vienna' — light green colour, 'Purple Vienna' — purple colour 'White Vienna' is more popular and better in flavour. | |
| Seed rate | 1 g/10 m ² (8 oz/acre) | |

LADY'S FINGER OR OKRA (*Abelmoschus esculentus*; Hindi: *Bhindi*)

Okra or Lady's finger as it is popularly called ushers the arrival of summer. Tender fore finger-sized ones stuffed with spices make a delicious vegetable.

It is recommended that the seeds should be soaked in water for 48 hours until the seed-coat splits because seeds have a hard coat. Must be sown immediately after, otherwise likely to die. I, however, find that germination in small gardens is no problem and equally good results are obtained without soaking provided watering is not neglected. Sow *in situ*. Researchers inform that the seeds germinate when the night temperature is 15° C or more.

Disease-resistant seed is important. Most common disease is mosaic to which 'Pusa Sawani' is tolerant.

| | Plains | Hills |
|------------|---|------------|
| Sowing | February-July (for South India in November also) | March-June |
| Harvesting | 60-75 days | 3 months |
| Spacing | 60-90 cm (2-3 ft) between plants | |
| Varieties | 'Pusa Sawani'; 'Pusa Makhamali', 'Perkins Long Green', 'Parbhani Kranti' — high tolerance to mosaic | |

Note: 'Pusa Sawani' was reported to be successfully grown over a long period of the year, in spring, summer and rainy season in the hills as well as in the plains. But the recent reports are that its tolerance to mosaic disease has been broken. 'Perkins Long Green' is suitable for north Indian hilly areas.

LETTUCE (*Lactuca sativa*; Hindi: *Salad*)

Lettuce is a must for those fond of salad. There are two types of head lettuces — cabbage and cos. Cabbage lettuce is easier to grow as it forms a natural head like

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cabbage. Cos lettuce is delicate, needs careful handling but it is more crisp and tasty. Both can be grown well in any reasonably good garden soil. There is another type with a loose cluster of crisp leaves with frilled edges. Its lower leaves are picked from time to time.

Lettuce in full growth has a white sap which gives it crispness. It oozes out profusely on cutting, known as bleeding and soon loses its freshness. Lettuce should, therefore, be cut immediately before use. It can be kept fresh for a day or two if it is pulled with root intact and the roots are kept immersed in water. The roots may be cut just before use. For continuous supply, fortnightly sowing should be done. In summer they do better in a semi-shady position. In winter, a sunny position should be given. It can also be taken as a subsidiary crop in intercropping with others.

Lettuce can be transplanted or sown *in situ*. In transplanting all its roots should be kept intact as, otherwise, it is likely to bolt. It is said that the lettuce transplants better if the tip of the tap root is cut off slightly. Transplanted lettuce having received a check, matures later than the other.

Bolting of lettuce is a frequent complaint. It can be prevented if uniform good growth conditions are provided, without any setback. Drought condition is one of the major causes. Regular watering, mulching and liquid manure help. Another common cause is that the soil is not as rich as required. The lettuce grows fast and forms a 'heart'. Hence it is better to provide rich soil in the beginning.

Cabbage lettuce has a natural mechanism for blanching. In cos lettuce blanching has to be aided by hand. When the plant is almost fully grown tie the outer leaves together about 7-10 cm (3-4 in.) below the leaf tips.

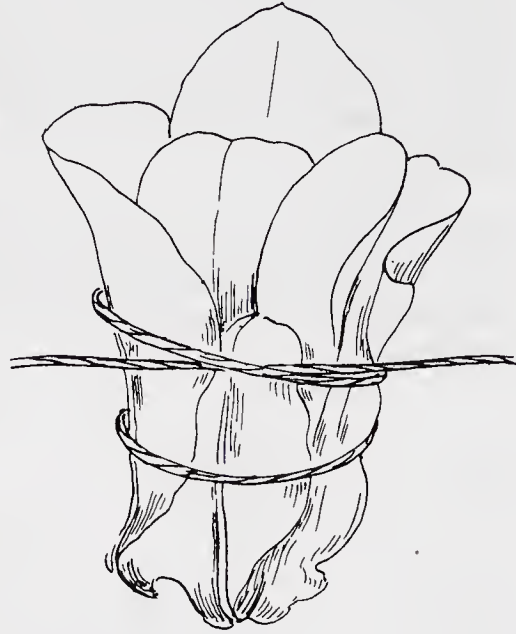


Fig. 20. Tying a cos lettuce

| | | |
|------------|--|--------------|
| | Plains | Hills |
| Sowing | September-February | March-August |
| Harvesting | 6-8 weeks | |
| Spacing | 30 cm (1 ft) between plants and 45 cm (18 in.) between rows | |
| Seed | 5 g/10 m ² | |
| Varieties | Cabbage Type: 'Great Lakes', 'Imperial'; Cos Type: 'Paris Giant White' Leaf Type: 'Grand Rapids', 'Chinese Yellow', 'Slobolt' | |

HOME GARDENING

MAIZE

(*Zea mays*; Hindi: *Bhutta*)

Maize is an unrivalled delicacy when freshly plucked and roasted. It loses sweetness within 24 hours when sugar gets converted into starch. Hence it has to be grown in your garden if you are a tender maize fan. If it becomes necessary to store, it should be kept cool. It should be collected when seed is well formed but its skin can be punctured with a finger nail. A downward twisting jerk will usually snap the ear from the stalk.

Maize does well in well-enriched sandy soil. Plant goes up to 1 $\frac{1}{2}$ -2 m (5-7 ft) height. Start earthing up the plant after it is 60 cm (2 ft) tall. This encourages side roots and provides better balance against strong wind. During the season it may require earthing up about three times. As it roots very near the surface, shallow cultivation is required.

| | | |
|------------|---|------------|
| | Plains | Hills |
| Sowing | March-April June-July | March-June |
| Harvesting | 3-3 $\frac{1}{2}$ months | |
| Spacing | 15 cm (6 in.) between plants and 60 cm (2 ft) between rows | |

MINT

(*Mentha arvensis*; Hindi: *Pudeena*)

Mint is a perennial popular Indian herb. Its leaves are used for flavouring as well as for medicinal purposes. It makes the most delicious 'chutney' or sauce when ground fine in combination with raw mango or pomegranate seed or lemon juice. It has cooling effect in summer. Mint is good for stomach ailments and also for cough and cold. It is boiled with tea water for making spiced tea.

Mint can be easily propagated by root division during the rains. Household requirement, though constant, is very little at a time. Therefore a very tiny corner, even 45-60 cm (1 $\frac{1}{2}$ -2 ft) is sufficient for it. The roots placed at a distance of 4-6 in. can cover the whole area in about 3-4 weeks.

Best time to propagate is in the rainy season. But roots establish themselves well enough in winter also. In summer, there is no difficulty in propagation if watering is done regularly. Though perennial, it is good to replant after a year or two in a new spot.

VEGETABLES – A KITCHEN GARDEN

MARROWS, VEGETABLE

(*Cucurbita maxima*, *C. pepo*; Hindi: *Chappan kaddu*, *Vilayati kaddu*)

There are two types of vegetable marrows — trailing and bush. More frequently encountered is the trailing type. But the bush type is growing in popularity in the cities as their spread can be confined to above one metre (3-4 ft).

Cultivation as for the gourds with the difference that the bush type may be sown in rows or pits with spacing between the plants and rows of 90 cm × 90 cm (3 ft × 3 ft). The crops take 3-4 months to be ready, like the pumpkins. There are species suitable for summer and winter.

For storing marrows lay them singly not touching each other on a dry clean shelf indoors; wipe with clean dry cloth once a week and gently turn them over.

| | |
|-----------|---|
| Varieties | <i>C. maxima</i> — ‘Arka Suryamukhi’ |
| | <i>C. pepo</i> — ‘Pusa Alankar’ and ‘Patty Pan’ |

MUSK-MELON

(*Cucumis melo*; Hindi: *Kharbooza*)

Musk-melon belongs to the family of cucurbits. In common usage, it comes under the category of fruits and not vegetables. Its ripe fruit looks very ornamental with rind of different colours, single, bi-colour or variegated—orange, apricot, apricot-green, brown-green, orange-green or yellow-green is a dessert fruit with sweet taste and fine flavour. Flesh is of apricot or white colour.

It thrives in hot and dry climate in sandy soil and hates rain, cold or water-logged condition. It is said that the hotter and drier the season, the sweeter is the fruit. With the onset of the rains, the fruit ceases to be sweet. It needs very well-manured soil. It is cultivated on raised beds and water is allowed in the furrows so that water does not touch the collar of the plant. Otherwise stem rot may take place. The vine is allowed to trail on the raised bed.

| | |
|------------|---|
| Sowing | February-March |
| Harvesting | 3 months |
| Spacing | 2 m between hills with 2-3 seeds per hill, after thinning |
| Varieties | ‘Pusa Sharbati’, ‘Lucknow Safeda’, ‘Hara Madhu’, ‘Durgapura Madhu’, ‘Arka Jeet’, ‘Arka Rajhans’, ‘Pusa Madhuras’ and ‘Punjab Sunheri’ are recent varieties released by the Institute of Horticultural Research, Hessaraghatta, Bangalore. The fruits are said to be sweet like ‘Sharda’ of Afghanistan. |

HOME GARDENING

WATER-MELON

(*Citrullus lanatus*; Hindi: *Tarbooz*)

Water-melon also belongs to the family of cucurbits. Its light or dark green hard skin contrasts beautifully with the bright crimson juicy pulp and black seeds inside. It is a deliciously cool dessert fruit. Its juice with a dash of lemon, salt and pepper is very tasty. Cut into small cubes, it combines well with other items of salad.

Its cultivation is similar to that of musk-melon with the difference that the fruits are much bigger and it takes about 4 months for the fruits to be ready. Spacing has to be 3 m between hills. Each hill has 2-3 seedlings after thinning. Its cultivation as a home garden plant needs to be popularized in India.

Varieties. Most popular variety is 'Sugar Baby' which is very sweet and fruit is medium sized. The others are 'New Hampshire', 'Midget' and 'Asahi Yamato'. 'Pusa Bedana' is a recent variety released by IARI.

ONION

(*Allium cepa*; Hindi: *Piyaz*)

Tender onions are used for salad. Mature ones are used as a vegetable as well as for various cooking processes, especially, the rich Indian 'curries'. It is a winter crop in the plains but requires warm and dry condition as it matures. In Maharashtra and south India, the crop is taken in rainy season also. In the hills, it is a summer crop.

When onion seedlings are 15-20 cm (6-8 in.) high (i.e. about 8-10 weeks old), they are transplanted. Select short-jointed, erect and healthy seedlings. A lean straggling seedling is likely to 'bolt'. When transplanting, bury not more than half the tiny bulb. Shape of the bulb will depend on upright foliage. Too much manure will give huge thick leaves but scarcely any bulbs. The bulb does not attract birds. Defective seed results in a plant with a thick neck without a bulb. Onions can be grown *in situ* also.

When the plant is almost fully grown, bend over each bunch of foliage 3-5 cm (1-2 in.) above the top of the bulb to cut off sap between the bulb and the leaves. This will suspend further growth of the leaves, and the sap will concentrate in the bulb. If tops are bent in one direction, the rows look neat. After a week or ten days, the crop may be harvested.

For harvesting the crop, cut off the top foliage just above the point of its bend. Use garden fork gently without damaging the outer scales. Shake off such soil as will fall off without effort. Do not disturb roots or the tops. After a fortnight of removal, roots will shrivel and will fall off by gentle rubbing with the hand. Tops do not detach so easily. A cut about 2.5 cm (1 in.) above the bulb can be made without loss or drop in sap.

VEGETABLES – A KITCHEN GARDEN

| | | |
|------------|--|------------|
| | Plains | Hills |
| Sowing | October-November | March-June |
| Harvesting | May-Early June | |
| Spacing | 10-15 cm (4-6 in.) | |
| Seed rate | 1 g/m ² | |
| Varieties | Red: 'Pusa Red', 'Pusa Ratnar', 'Patna Red'; Light yellow: 'Early Grano', 'N-53' – suitable for <i>kharif</i> White: 'N 257-9-1', 'Pusa White Flat', 'Pusa White Round'. | |

PALAK

(*Beta vulgaris* var. *bengalensis*)

A leafy vegetable popular for its nutritive value, easy to grow and ready availability. It does well in tropical and sub-tropical areas only.

It can be cultivated nearly throughout the year in succession at fortnightly intervals. In the rainy season it is susceptible to rot. The common practice is to raise the bed by 5 cm (2 in.) during this period. It is ready in 30-45 days, 4-5 pickings can be taken in a crop.

Sow in drills and thin out to 20 cm (8 in.) between plants and 30-40 cm (12-16 in.) between rows. Recommended varieties are 'Pusa Jyoti' with big leaves and 'All Green' with regular smaller leaves. 'Pusa Jyoti' is not so tasty. Seed requirement is about 3 g per 10 m². Please also see under 'spinach'.

PARSLEY

(*Petroselinum sativum*; Hindi: *Woio*)

A sister of mint, for the hills, with the advantage of very showy crinkled dark-green leaves. Its leaves are, therefore, used not only for flavouring but also for decoration. It is an excellent decoration material for sandwiches and salads. In north India it can be grown as an annual during the winter. In the hills it is a perennial herb. It can be easily grown from seed sown in March-April *in situ* or transplanted. Takes 6-8 weeks to be ready. Flower buds should be cut back as soon as they appear. About 4 plants should be sufficient for a family. Though perennial, it is good to replace the plant every 2-3 years.

PEAS

(*Pisum sativum*; Hindi: *Mattar*)

Peas belong to the same family as the beans and their general cultivation practices are similar, but peas comparatively are delicate and are more particular regarding

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temperature and humidity. They hate hot and humid climate and thrive better in cold and dry weather. They are more susceptible to diseases also. The ideal situation in the beds is north to south. They can be cultivated in the plains only in winter. In hilly regions with heavy rain and no snowfall, they are cultivated in winter.

Peas are fond of phosphorus and calcium. For each metre-run 50 g of basic slag and 100 g of wood-ash (each yard of run 2 oz of basic slag and 4 oz of wood-ash) is recommended. Deep trenching up to 3 spits, i.e. 70 cm ($2\frac{1}{2}$ ft) and manuring as in sweet peas is essential. Peas grown in shaded areas are susceptible to mildew. Peas which are allowed to suffer from dryness, pass out of cropping.

Pinch off the growing shoots when pods are less seeded. Varieties are wrinkle-seeded and smooth-seeded: the former are sweeter, more flavoured and better quality but more delicate. The yield of smooth-seeded one is more. Beware of the birds and rats who are very partial to the seeds and newly sprouted seedlings. Stake as for sweet peas with multiple vertical stakes. In the plains the varieties like 'Early Badger' do not grow tall and are allowed to trail on the ground. For commercial production also, peas are allowed to trail and are not staked. Even 'Bonneville' which is the main crop variety is allowed to trail. But for better yield and prevention from diseases, it is better to stake the peas in the kitchen garden.

For gathering peas, use a pair of scissors. Breaking with hands involves risk of pulling off a number of immature pods or breaking down the vine. The developed tender pods should be collected; if green seeds are wrinkled or hard, they have been allowed to remain too long.

Seeds can be raised in the plains. It is a self-pollinated crop. Unshelled peas keep better than the shelled ones, whether green or dry.

| | Plains | Hills |
|------------|--|---|
| Sowing | October-Middle of December | (1) March-June where rain is less than 25-30 in. (2) October |
| Harvesting | Early: 60-70 days Main crop: 80-100 days Late: Over 100 days | Early: 3-4 months Main crop: 4-5 months |
| Spacing | Sow in double drill 10 cm (4 in.) between seeds and 45-60 cm ($1\frac{1}{2}$ -2 ft) between each double drill. | |
| Seed rate | About 50 g/10 m ² (2 oz/100 ft ²) | |
| Varieties | Early: 'Early Badger', 'Early December' and 'Arkel' as wrinkle-seeded for the plains. 'Early Giant' (wrinkle-seeded) for the hills. Main: 'Bonneville', 'American Wonder' as wrinkle-seeded for the plains. 'Lincoln' (wrinkle-seeded) for the hills. 'Alderman' (wrinkle-seeded) and 'GC 195' (wrinkle-seeded) suitable for the plains and the hills. Late: 'N.P. 29' for the plains. | |

Note: 'Bonneville' has become very popular in North India because of its good yield quality and tolerance to diseases. There is an edible, podded one, like a bean, named 'Sylvia'.

VEGETABLES – A KITCHEN GARDEN

POTATO

(*Solanum tuberosum*; Hindi: *Alu*)

The potato is easily the most popular vegetable all over the world. It offers the richest varieties of preparations. It can be cultivated in any garden soil. Light, well-dug, well-manured, and well-drained soil is the best.

Potato is very susceptible to seed-borne virus disease. Therefore, buy seed certified by National Seeds Corporation or any other reliable agency. In the plains, seed needs to be stored in cold storage during summer. Therefore, it is not advisable to keep your seed.

It is better to sprout potatoes for seed before planting. This can be done by laying potatoes in a dry place without their touching each other. Allow an eye to grow to about 1 cm ($\frac{1}{2}$ in.). A better method is to stand the potatoes in wooden frame or trays. In the hills the trays are arranged north to south so that all seeds get sunshine equally. Stand the potato on its level, i.e., flat end of tuber where it was attached to the sucker producing it. The opposite or 'rose' end has strong and several eyes. The tubers which do sprout should be discarded. Any shrivelled potatoes may be sprayed well with water before placing for sprouting.

For seed, tubers of hen-egg size are better. It was earlier recommended that bigger potatoes should be cut into two or three with about 2-3 eyes each. But this has been modified, and seed potatoes should not be cut. Handle the sprouted potatoes gently lest sprouts are broken. Even others need to be handled carefully as bruising will damage the eyes.

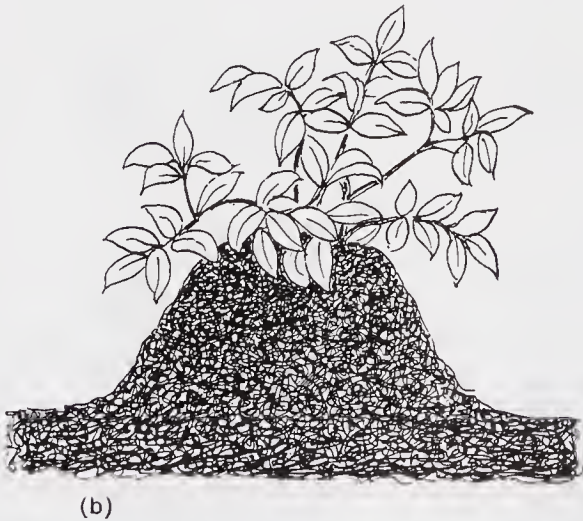


Fig. 21. Earthing up of potatoes

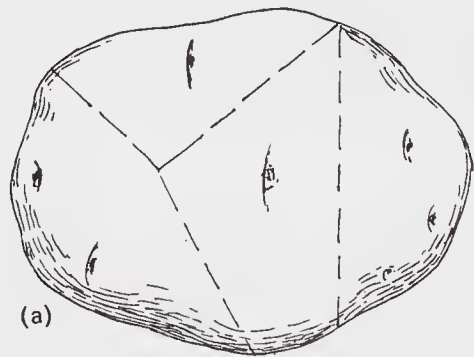


Fig. 22. Cutting a potato tuber with one or two eyes before planting

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| Region | Crop | Planting | Lifting | Manurial and fertilizer schedule(m) | Seed rate (m ²) | Spacing | Varieties recommended |
|--|--------------------------|------------------|-------------|--|--|------------------------------------|---|
| A. Plains (North-western, Jammu, Punjab and part of Rajasthan bordering Punjab) | Autumn (early) | Sept. (2nd half) | Nov.-Dec. | | 300-400 g | Inter row =55 cm | 'Kufri Chandramukhi', 'Kufri Alankar', 'Kufri Sindhuri' |
| | Main | Oct. (1st half) | Dec.-Jan. | | | Intra row -20 cm (Plant to plant) | 'Kufri Sheetman' and 'Kufri Bahar' |
| | Spring | Jan. (1st half) | Apr.-May | i) Well-rotted: 4-5 kg F.Y.M. or city compost. | 300-400 g | -do- | 'Kufri Chandramukhi', 'K. Alankar', 'K. Sheetman and 'K. Sindhuri' |
| | Autumn (Main) | Oct.-early Nov. | Dec.-Feb. | ii) Ammonium sulphate: 60 g Cal. Amm. | | | |
| | Spring | Dec.-early Jan. | Mar.-Apr. | | | | |
| | Autumn (early) | Sept.-Oct. | Nov.-Dec. | iii) Superphosphate 37.5-40 g Nit: 60 g | 300-400 g | -do- | 'Kufri Chandramukhi', 'Kufri Jyoti, and 'Kufri Sindhuri' |
| | Winter | Nov. | Feb.-March | iv) Sulphate of potash: 25-30 g or | | | |
| | Winter (<i>rabi</i>) | Oct.-Nov. | Jan.-Feb. | Muriate of potash 20-25 g | 300-400 g | -do- | 'Kufri Lovkar', 'K. Chandramukhi', (Both <i>rabi</i> and ' <i>kharif</i>), 'K. Sindhuri' (<i>rabi</i> only) |
| | Summer (<i>kharif</i>) | June-July | Oct.-Nov. | | 250-300 g (medium-sized tubers approximating the size of a hens egg) | -do- | 'Kufri Chandramukhi', 'K. Jyoti', 'K. Jeevan', 'K. Naveen' |
| | | | | | 250-300 g | Inter row = 55 cm | 'Kufri Jyoti', 'K. Chandramukhi', 'Kufri Naveen' and 'Kufri Sherpa' |
| B. Plateaux (Maharashtra), Ranchi (Bihar), part of M.P. | Spring | Feb.-March | June-July | Well rotted F.Y.M. : 4-5 kg | | | |
| | Summer | April | Aug.-Sep. | Ammonium-sulphate: 60 g or Calcium ammonium nitrate 48-50 g | | Intra row = 20 cm (plant to plant) | |
| | Summer | Jan.-Feb. | June-July | Superphosphate : (single) 75-80 g Sulphate of potash: 25-30 g or Muriate of potash 25-30 g | | | |
| | Summer | March-April | July-August | | | | |
| C. Hills (Himachal, J & K and Kumaon) | Spring | Feb.-March | June-July | | | | |
| | Summer | April | Aug.-Sep. | | | | |
| | Summer | Jan.-Feb. | June-July | | | | |
| | Summer | March-April | July-August | | | | |
| D. Eastern (Khasi, Garo and Darjeeling) | Spring | Feb.-March | June-July | | | | |
| | Summer | April | Aug.-Sep. | | | | |
| | Summer | Jan.-Feb. | June-July | | | | |
| | Summer | March-April | July-August | | | | |
| E. Southern (Ootacamund and Kodaikanal) | Spring | Feb.-March | June-July | | | | |
| | Summer | April | Aug.-Sep. | | | | |
| | Summer | Jan.-Feb. | June-July | | | | |
| | Summer | March-April | July-August | | | | |

VEGETABLES — A KITCHEN GARDEN

Farmyard manure/compost should be applied before planting and worked into seedbed in the top soil 10-15 cm (4-6 in.). Plant tubers upright with the rose end above, at a depth of 10-15 cm (4-6 in.). Give light watering. Plants are 25 cm (9 in.) high, earth up to the ridges about 15 cm (6 in.) high. In the hills the ridges are made along with the earthing up operation. While watering ridges should not be submerged. Second earthing is required after full emergence of the crop. Before earthing, weeding-cum-hoeing should be done. Normally two earthings are sufficient; sometimes three are required. Ridges should remain 15 cm (6 in.) below the top of average shoots. When leaves turn yellow, tubers are ripe. But even before that, you can test for ripeness. If you hold a tuber between thumb and finger and rub vigorously the skin breaks, it is not ripe; if it remains unbroken, it is ready.

Cut off the leaves. Let it remain for three-days for 'curing'. Dig out and let the tubers remain exposed to the sun and wind for 24 hours. This provides for a natural process of removal of moisture. A common damage to potato is due to wrong method of lifting. It should be lifted gently without causing cuts to the tubers. You should go over the field twice as quite a few of them get left out in the first round.

The potato, like tapioca, enjoys the advantage of flexibility of harvesting over a long period according to home requirement, once it has reached the minimum stage of maturity, e.g. in early varieties in the plains after 60 days up to 90 days or in the hills from 100 to 130 days. Thus it ensures a fresh supply for a remarkably long period.

The potato blight is a serious disease, which occurs usually when plants are fully grown. Potato tubers can develop a hard green patch due to potash deficiency.

Many new varieties are now available from the National Seeds Corporation. The recommended early and main varieties are as follows:

Early: 'Kufri Chandramukhi', 'K. Jyoti', 'K. Moti', 'K. Lovkar', 'Great Scot'

Main: 'Kufri Chamtkar', 'K. Sheetman', 'K. Sindhuri', 'K. Jeevan', 'K. Naveen'

The suitability of these varieties to different regions and their cultural practices vary. A statement is attached.

PUMPKIN

(*Cucurbita moschata*; Hindi: *Peela kumhra*)

Pumpkins belong to the family of cucurbits and can be cultivated like bottle gourds. There are many varieties of different shapes, colour and size. The colour of the rind varies from green-yellow to orange-yellow with pulp of light-yellow to orange-yellow colour. They are round, long with or without ridges. Size may vary from 5 kg to 40 kg. Some of the best pumpkins are grown in the fields in which the last crop was that of potato.

They can be cooked as a vegetable like vegetable marrow; make most economical jams which can be flavoured with lemon. They are also used for sauces for commercial

HOME GARDENING

purposes with suitable spices and flavouring. Pumpkin pies or dumplings are like national dishes in some countries.

| | | |
|------------------|--|-------------------------|
| | Plains | Hills |
| Sowing | Summer: January-March Rains: June-July | March-May |
| Harvesting | After 3-4 months for a period of 8-10 weeks | 4 months for 8-10 weeks |
| Spacing | As for the bottle-gourd | |
| Seed requirement | As for the bottle-gourd. Twice as that of bottle-gourd, i.e. 8 g for 10 m ² | |
| Varieties | North: 'Pusa Vishwas' South: 'Arka Chandan', 'Co 1'. | |

RADISH

(*Raphanus sativus*; Hindi: *Moolee*)

The radish can grow successfully in the hills as well as in the plains. It may be long, cylindrical or tiny globular. It may be red, white or mixed red-white. Besides a very popular salad vegetable, it is a popular stuffing for cooked 'rotis' in North India. Its tops are also cooked as a leafy vegetable. Sow radish *in situ*. The long cylindrical types are known as sub-tropical or Asiatic. In the plains, they should be grown on ridges. The height of the ridge will depend on the variety. The others known as temperate or European types can be raised without much effort.

The sub-tropical radish forces itself out by 2-5 cm (1-2 in.) if its roots do not find favourable ground underneath. The soil should, therefore, be well-dug, according to variety. It can be grown as intercropping with another main crop. Radish should be earthed up.

| | | |
|------------|---|--------------|
| | Plains | Hills |
| Sowing | July-January | March-August |
| Harvesting | 3-4 weeks for globular or oval varieties. 2-3 months for long cylindrical types. | |
| Spacing | 5 cm (2 in.) between plants for small varieties. 10-15 cm (4-6 in) between plants and 30-40 cm (12-16 in.) between rows for bigger varieties. | |
| Seed | 10 g/10 m ² | |
| Varieties | Sub-tropical types: 'Japanese White', 'Pusa Chetki', 'Pusa Desi', 'Pusa Rashmi', 'Jaunpuri'; Temperate types: (a) Globular varieties — 'Scarlet Globe', 'Red Top'; (b) Oval varieties — 'White Icicle', 'White Globe', 'Pusa Himani' Local selection 'R.S.1' is reported to be very good for the Khasi Hills. Sowing and seed raising as for turnip and carrot. | |

VEGETABLES – A KITCHEN GARDEN

SPINACH

(*Spinacea oleracea*; Hindi: *Vilayati Palak*)

A leafy vegetable with dark-green succulent leaves. It has a stronger flavour than the Indian *palak*. It does well in the hills as well as in the plains. The leaves die due to heavy frost in winter in the hills. It comes up by itself in March-April as the weather warms up. A number of cuttings can be taken from June till December-January. In the plains it can be grown in winter only. Best grown under a roof projection in the hills to save the plants from heavy frost, and under semi-shade in the plains. For the hills, there are varieties for summer and for winter. For the hills, it is a substitute of *palak*. Spinach has deep roots; therefore, soil should be deeply dug. As a number of cuttings over a long period are taken, soil should be well-enriched also. Flowering shoots should be pinched off.

| | | |
|------------|--|--------------------------------|
| | Plains | Hills |
| Sowing | October-November | March-June August-September |
| Harvesting | | 2-2½ months onwards |
| Spacing | 20 cm (8 in.) between plants and 40 cm (16 in.) between rows | |
| Seed | 3 g/10 m ² | |
| Varieties | ‘Virginia Savoy’ and ‘Early Smooth Leaf’ are recommended varieties | |

SWEET POTATO

(*Ipomoea batatas*; Hindi: *Shakarkandi*)

Sweet potato is a tuber crop cultivated in the tropics throughout the year. In the hills up to about 1,500 m (5,000 ft) it can be cultivated as a summer crop. It is a climber which produces tubers at the nodes under the ground. The tuber is consumed after boiling. Boiled and fried golden sweet potato with a sprinkling of salt and lemon is very delicious. There are many varieties with off-white and brown-red rind, almost round to long.

Sweet potato can be propagated from 20-30 cm (8-12 in.) cuttings taken from the vines of previous crop or from the fresh growth from the tubers. Make the ridges 30 cm (12 in.) high and 60-75 cm (2-2½ ft) apart. Plant the cuttings on these ridges. The central part of the cuttings is buried in soil and the two ends are kept clear of the soil. Vines should not be allowed to form roots at all the underground nodes. They are, therefore, turned over frequently to prevent and disconnect such root-growth. This helps in increasing the size of tubers. The plant should be earthed up when 4-5 weeks old.

When the leaves turn yellow and the soil shows cracks, vines are cut. Tubers are lifted after a week.

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| | |
|------------|--|
| Planting | June-July September-October |
| Harvesting | After 4-5 months |
| Spacing | 20-30 cm (8-12 in.) between plants and 60-75 cm (2-2 $\frac{1}{2}$ ft) between rows |
| Varieties | 'H-41' and 'H-42' bred by Central Tuber Crops Research Institute, Trivandrum. 'Pusa Lal', 'Pusa Safed', 'Rajendra Shakarkand' and 'Kalmegh' |

TAPIOCA

(*Manihot esculenta*; Hindi: *Sakarkanda*)

A starchy crop for the tropics, it is a very important food source in hot and humid region in India. It is boiled or roasted before eating. It is converted into a number of edible products as sago, semolina and flour. Its 'papad' is popular.

The plant is ornamental with its tall, erect branching habit. Its variegated variety is cultivated widely as a garden plant and does well in Delhi also. It can be easily propagated from cuttings 15-20 cm (6-8 in.). It is not particular about soil requirements so long as it is well drained and has direct sunshine. It does well up to 1,000 m (3,280 ft) above sea level. The land should be ploughed to a depth of 25-30 cm (10-12 in.). In acid soils application of lime is beneficial. The plant should be earthed up when about 3 months old. Retain only two shoots per plant and remove the others when the plant is one-and-a-half months old. As this is a long-duration crop, intercropping with a leguminous crop is helpful.

Lifting of tubers for household consumption can start when plant is 9 months old and can be continued till it is 12 months old.

| | |
|------------|---|
| Planting | March-April, June-July Planting can also be done in September in tropical areas |
| Harvesting | After 9-10 months |
| Spacing | Between plants and rows 90 cm (3 ft) |
| Yield | One plant can give 5-6 kg |
| Varieties | 'H-1687', 'H-2304' developed by the Central Tuber Crops Research institute, Trivandrum. |

TOMATO

(*Lycopersicon lycopersicum*; Hindi: *Tamatar*)

A tomato plant with bunches of red tomatoes on both sides of the main stem makes a lovely sight. It loves sunshine (though, of course, not the hot summer of the plains) and is not happy with too much rain. A south or south-west position in hills, or in

winter in the plains, away from any overhanging branches of trees, should be reserved for tomatoes.

Select firm, sturdy and short-jointed seedlings with leaves bright dark-green and free of trace of blight or mildew. Transplant them when 4 pairs of leaves (about 3-4 in.) have grown. Train the tomato plant from the beginning with single stem and 4-5 trusses of fruits. As main stem develops, numerous side shoots appear in the leaf axil with the stem. Pinch this off as soon as they appear. Flower trusses also form at this point. Therefore, one should be careful not to damage them. There is no chance of confusing the side shoot with the flower truss. A side shoot begins with a leaf, while a flower truss with a flower.

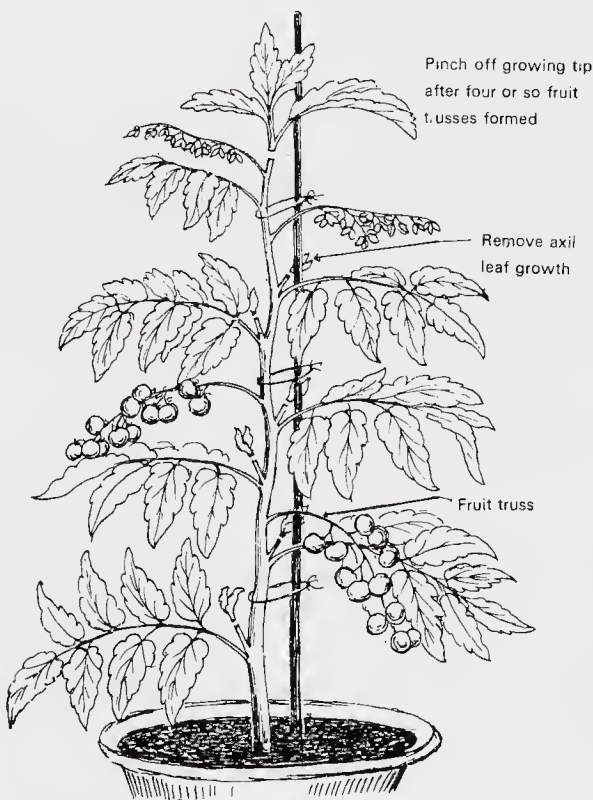


Fig. 23. A tomato plant

When the plant forms 4-6 trusses, stop it by pinching out the growing tip of the main stem. Allow side growth, but not side shoots, to develop without further pinching. Allow side shoots to trail. To protect fruits put a cover of straw under the plant. It is a good plan to support individual fruit trusses as weight of a heavy truss may snap the stem.

Gather fruit that is just reaching the ripe stage. Do not leave it till a tiny crack appears at the stalk end, or a softening of skin indicates complete ripeness. Nip off each fruit with a short stalk attached. This prevents quick deterioration. Place each fruit separately in a basket filled with straw or wrap each one in tissue paper and place in single layers in a tray or box. The crop is likely to develop more diseases if tomatoes

are grown successively in the same soil. Fruit splitting in tomatoes takes place due to flow of excess sap so vigorously that the skin is not elastic enough to cope with the pressure and cracks. This generally results from irregular or heavy watering. If leaves droop due to sudden hot spell, light watering should be given instead of thorough drenching.

Sometimes the tomato fruit colours up everywhere except around the stalk. If the patch is green and hard, it indicates potash deficiency. Give each plant half a teaspoonful

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of potash at fortnightly intervals; only two applications are enough. The colour will improve. Permanganate of potash given weekly one ounce dissolved in two gallons of water, 250 cc per plant is also reported to give higher yield, and better colour. Sometimes fruit setting is impaired due to high or low temperature.

| | Plains | Hills |
|-------------------|---|------------|
| Sowing | Autumn crop: June-July Winter crop: November | March-May |
| Harvesting | Early: 60-80 days Main: 80-100 days | 3-4 months |
| Spacing | 45-60 cm between plants and 60-75 cm between rows | |
| Seed requirements | 18 g/25 m ² | |
| Varieties | Early: 'Pusa Ruby', 'Sioux', 'Best-of-all', 'H.S. 102', 'Pusa Early Dwarf' Main: 'Marglobe', 'Italian Red Pear' (pear shaped), 'Yellow Plum', 'SL-120' (resistant to root nematode), 'Roma', 'Punjab Chhuhara', 'Pusa Gaurav' | |

For tree tomato see under fruits.

Note: 'H.S. 102(HAU)' and 'Punjab Chhuhara' are very good varieties.

TURNIP

(*Brassica rapa*; Hindi: *Shalgam*)

Turnip requires a cultivated taste. Those fond of it, find it excellent as a salad. It is also a tasty boiled or cooked vegetable. Its flavour is strong. Cultivation as for carrots, except that its roots are less deep and it is less fussy about the soil.

There are subtropical and temperate types. The temperate types require cooler climate and are, therefore, sown as winter crop in the plains preceded by the subtropical types in autumn. No recognised important variety in subtropical types.

| | Plains | Hills |
|------------|---|--------------------------------|
| Sowing | Subtropical: July-September Temperate: October-December | March-May September-October |
| Harvesting | Early: 50-60 days Main crop: 60-75 days | |
| Spacing | 15-25 cm (6-10 in.) between plants and 30-35 cm (15 in.) between rows | |
| Seed | $\frac{1}{2}$ g/m ² or about 10 oz./50 yd ² . Seed raising as for carrots | |
| Varieties | Early: 'Snowball', 'Early Milan Red Flat', 'Early Milan White Flat', 'Pusa Kanchan', 'Pusa Chandrima', 'Pusa Sweti' Main: 'Purple Top White Globe', 'Golden Ball', 'Pusa Swarnima'. | |

17

FRUITS

IT is advisable to have a separate space allotted to the fruit trees to avoid their shading the vegetables or flowers. But generally a home garden seldom permits this luxury. A few fruit trees or shrubs can easily be accommodated in the kitchen garden as discussed in a previous chapter. The arecanut is not a fruit tree, but enjoys pride of place in small gardens in the coastal and hot and humid regions. Its tall and slender shape lends grace to the garden and can provide a support to the vines.

A coconut tree in the southern and eastern plains, a mango in the other plains and a walnut in the hill areas are trees of life interwoven with religion and culture. They are honoured and looked after like members of the family. They provide food, fibre, fuel besides the thatch, timber, etc. If space permits a place of honour may be assigned to them in the respective regions.

Location and choice of fruit trees. The fruit trees, if they are a part of a kitchen garden, should be mainly in the borders or corners. Care should be taken that they are not on the east or south side. In the plains, they may be planted on north, north-east and north-west side in such a manner as not to shade the rest of the area, especially in winter. In the hills, they should normally be on the south or south-west or west side. The fruits of the trees on the east side are likely to crack due to rapid heat on sunrise, and the north side may be too cold. A combination of quick-growing and fairly quick-growing fruit plants will enable the gardener to enjoy the fruits of his labour within a short time even if he is on a transferable job.

Among the shrubs bearing fruits, which may include vines also, some of the select ones are the pineapple as tropical, the grape, *karonda* and *phalsa* as subtropical; and currants, gooseberry, raspberry and strawberry as temperate ones.

Among fruit trees the select ones may be banana, *ber*, coconut, custard apple, guava, jack-fruit, lemon, lime, mango, papaya and *sapota* as tropical; the fig, grape fruit, litchi, loquat, *mosambi*, orange, pomegranate and tree tomato as subtropical; and the apple, cherry, peach, pear and plum as temperate fruits. Dry nut is a delicacy but tender

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nuts is a rarer delicacy and a real delight. If, therefore, the garden permits why not try a cashewnut tree if you are not far from the sea coast, a *chironji* tree if in the hot and dry regions, or chestnut and walnut if in the hills. Almond is a little exacting about its climatic requirement of a dry temperate climate, and may be chosen if you are lucky to enjoy such a climate.

The temperate fruits are mostly deciduous, while the tropical and subtropical are mostly evergreen. Grapes and *phalsa* of the subtropics are deciduous. Some fruit trees may be dwarf under certain climatic conditions and very vigorous in different ones, e.g., 'Neelum' mango is dwarf in north India and vigorous in south India. The fruit trees show alternate fruit bearing in some cases. This is more marked in mangoes and in the apples.

ESSENTIALS OF FRUIT CULTURE

The essentials of fruit culture are basically the same as of flowers and vegetables but the degree of emphasis may vary. There are certain common requirements and practices of fruit culture. Some of the essentials are discussed below.

Procurement of plant material from a reliable source is a must. In case of vegetables or flowers a season only may be lost but in case of fruits, labour of a number of years may be lost if the plants turn out to be of inferior quality.

It is advisable to select dwarf varieties for small home gardens in preference to the tall ones if yield of the dwarf varieties is reasonably good.

The blossom of some of the fruits possesses male and female flowers but their ability to set fruits varies considerably, some of them are self-sterile. This is more common in the temperate fruits. The right pollinators have, therefore, to be provided, or should be available in the locality.

Propagation. The propagation is mostly by budding or grafting on select stocks. In grafting, the stocks are different for different fruits. Plants on dwarf stocks may be selected, e.g., Malling 9 stock for the apple. The growth as well as disease resistance depends to a considerable extent on the right choice of the root-stock. Some fruits like papaya, guava, *phalsa* and *karonda* are propagated by seed. Grapes are propagated by cuttings and bananas, strawberry and pineapples by suckers.

Planting. Preparation of pits/

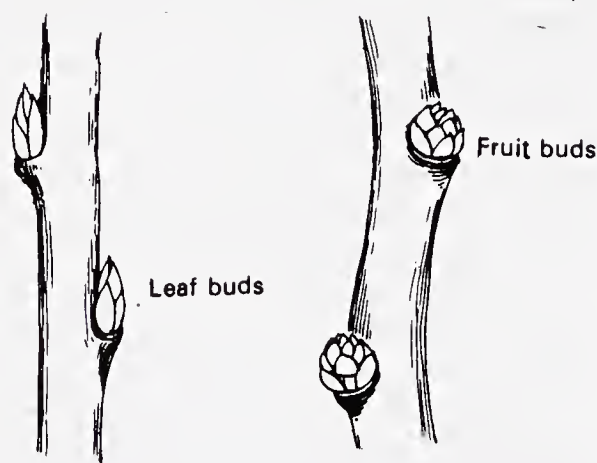


Fig. 24. Fruit buds and leaf buds in fruit trees (apple)

beds for fruit plants needs deep digging-pits about 30 cm × 30 cm × 30 cm (1 ft × 1 ft × 1 ft) for shrubs and 60 cm × 60 cm × 60 cm (2 ft × 2 ft × 2 ft) for small trees. The pits may be 90 cm × 90 cm × 90 cm (3 ft × 3 ft × 3 ft) for bigger fruit trees. Earth up the plants when well established.

The best time for planting in the plains and low elevation is during the rains in July-August for the evergreen and for the temperate fruits or the deciduous trees and shrubs is December-January in the plains and November-December in the hills. If the ground is very soggy or snow-bound in November-December, the planting can be postponed till February.

Spacing should be based on the expected spread of the tree at the time of its maturity. Its fragile form at the beginning may be misleading.

Watering and manuring. The plant needs copious watering when in blossom and fruiting. It is helped by liquid manure at that stage. Water-logging conditions are harmful. Some of the fruits like papaya and peach are more susceptible to collar rot due to excessive watering or waterlogging. Watering during the period of rest in December-January in trees like peach results in excessive and early leaf-growth which affects fruit setting. Some trees like guava flourish even in poor drainage conditions. It is advisable to make a wide basin around the trunk of the tree. The basin may roughly be as wide as the spread of the branches of the tree. The soil may slope towards the edge of the basin. Excess water may be allowed to drain off by digging a narrow channel from the edge of the basin.

Generous manuring is necessary before planting and needs to be supplemented once or twice immediately before or after flowering. One small tree would need initially and thereafter annually about one basket (10 kg) of well-decayed farmyard manure, $\frac{1}{2}$ basket each of leaf mould and wood-ash and 1 kg of bonemeal. A shrub may need half this quantity.

Pruning. More pruning is required in the temperate than in the tropical fruits. All fruit vines like grapes and shrubs need training. Some of the fruit plants like *phalsa* can be maintained as bushy shrubs of about 60 cm (2 ft) by rigorous pruning. It fruits on new growth. *Karonda* also needs pruning for bushy growth. Guava, 'Lucknow 49' can be trained as branching type by cutting off the top when 2-3 m (7-10 ft) high. Lemon and lime also need to be clipped. The grapes are pruned in north India during January. Heavy pruning in bearing trees is not practised in the tropical fruits. In the pre-bearing age, pruning depends on the type of training to be given to the plant.

The fruit spurs are small shoots with three or four buds. The temperate fruits are borne on fruit spurs and/or shoots, in some cases of the previous years and in some cases new. A peach tree fruits on one year, apple on two years, apricot on three years, plum on five-eight and cherry on 10 to 12-year-old spurs. The pruning is comparatively severe in those trees which fruit on younger spurs and also on the late bearing varieties of the same fruit. In peaches, the laterals are cut back by one-third and side shoots are cut back to about 3-4 buds each. The tree is given an open fan-like crown shape with a cut just above

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the outward eye. This may be supplemented by summer pruning in the hills of inside shoots but not lateral ones.

If a fruit tree continues excessive vegetative growth and fails to fruit in spite of regular pruning and control of manure, further remedies recommended are root pruning and bark ringing. In root pruning, in the early winter for temperate and deciduous fruit trees and shrubs and in the beginning of rains for the others, a semi-circular trench is dug at a distance of about 1 m ($3\frac{1}{2}$ ft) from the trunk of the tree. All the roots thus exposed are severed. In the next winter, the other part is similarly treated. Sometimes the bottom of the tap root is also severed at the same time. This is not so drastic measure as it may seem. I saw it being successfully practised by an amateur in New Delhi on a grape vine.

In bark ringing or girdling which is less drastic, a semi-circular ring about $\frac{1}{2}$ cm ($\frac{1}{4}$ in.) wide up to the depth of the bark is made and the bark is removed. Another ring about 10 cm (4 in.) apart, of the same type, is made in the other semi-circular region. The cut is covered with polythene film. If the tree is big, only branches may be girdled. The cut should be of the smallest width so that the wound may heal up early.

Fruit picking. When the fruits are ripening considerable damage takes place due to birds. Precautions to save the fruits by spreading bird-nets or covering each fruit with a white muslin cloth is necessary.

When the fruits are borne in clusters as in grapes, litchis or apples, thinning of fruits becomes necessary to get a good size of fruits. Most of the fruits will ripen if they are cut when fully developed and still green. But some like grapes and citrus do not ripen once severed from the plant.

FRUIT SHRUBS AND TREES FOR GARDENS

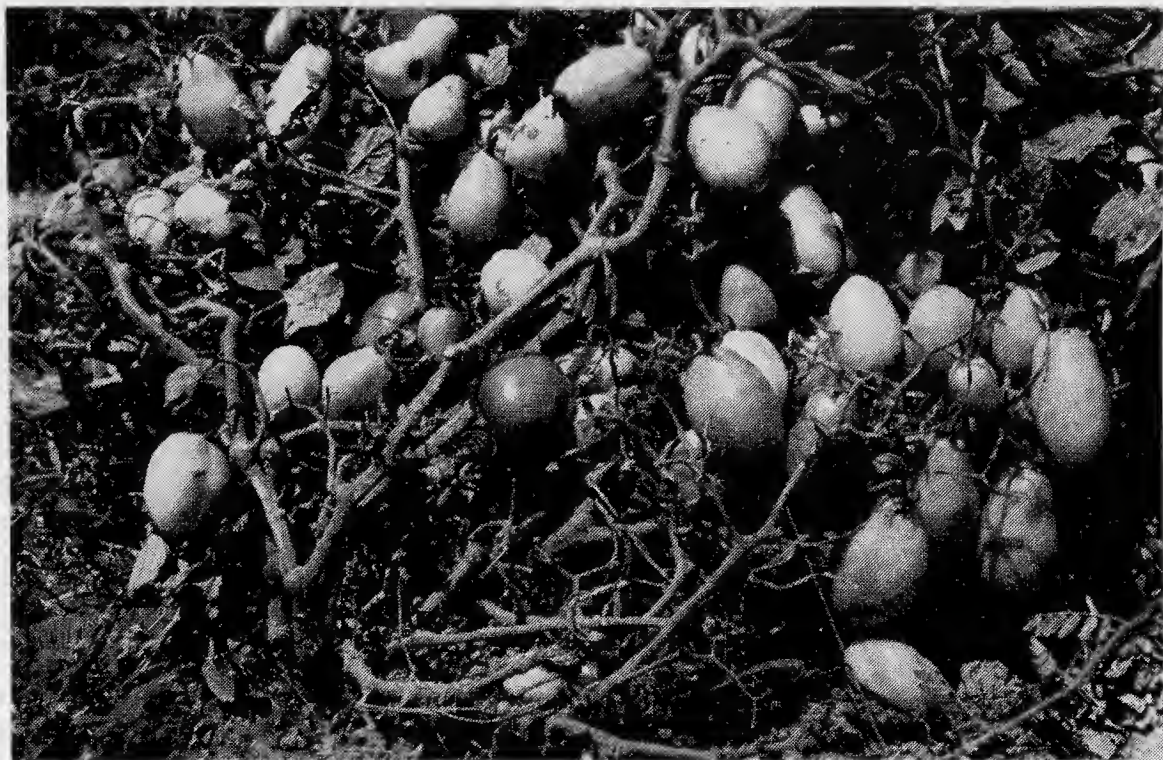
The following fruit shrubs and trees are recommended for kitchen gardens. Their selection will depend on the space available.

1. FRUIT SHRUBS AND VINES

| <i>Tropical</i> | <i>Subtropical</i> | <i>Temperate</i> |
|-----------------|--------------------|------------------|
| Pineapple | Grape | Gooseberry |
| <i>Karonda</i> | Passion fruit | Raspberry |
| <i>Phalsa</i> | Strawberry | Strawberry |

2. TREES

| <i>Tropical</i> | <i>Subtropical</i> | <i>Temperate</i> |
|-----------------|---|------------------|
| Banana | Fig | |
| Coconut | Grapefruit | Apple |
| Custard apple | Lemon | Apricot |
| | <i>Mosambi</i> , litchi, mulberry, loquat, orange | |
| Dwarf mango | | Cherry |



128. Tomato, 'Punjab Chuhara'

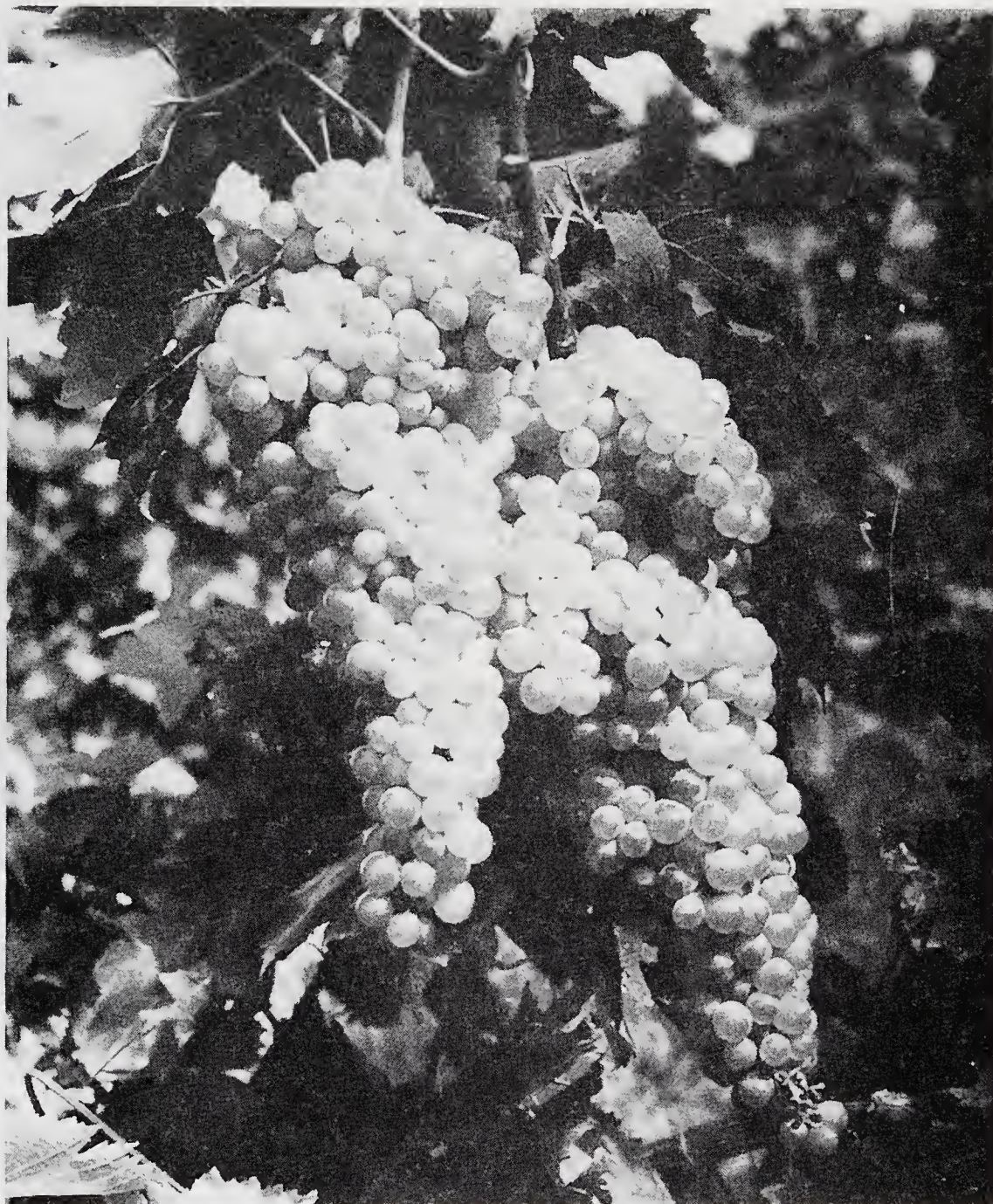


129. Fibreless 'Banarsi'
aonla rich in vitamin C

130. The banana, consumer's delight



131. Custard apple, a drought-resistant fruit



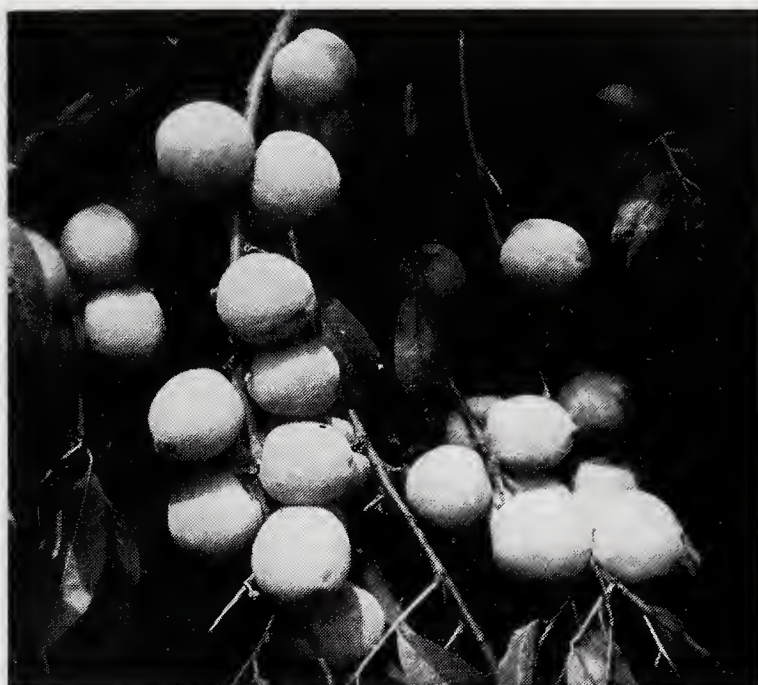
132. Grapes, 'Pusa Seedless'

133. 'Malika' mango, a hybrid of
'Dusehri' and 'Neelum'



134. The guava, needs a cultivated taste

135. The peach a temperate stone fruit becoming popular in New Delhi



136. The papaya, delicious fruit and an ornamental plant

137. The *phalsa*, deserves more recognition



138. The pear, welcome as raw or ripe fruit



139. Pineapple, a delicious fruit
for table drink or sauce

140. Plum blossom





141. Strawberries

| | | |
|------------|-------------|-------|
| Guava | | Peach |
| Jack fruit | | |
| Lemon | Pomegranate | Pear |
| Lime | Tree tomato | Plum |
| Papaya | | |

Spacing. The distance between the shrubs may be $1\frac{1}{2}$ – $2\frac{1}{2}$ m (5-8 ft) except in strawberries where it may be 45-60 cm ($1\frac{1}{2}$ – 2 ft) and in pineapple 90 cm (3 ft). The distance between small trees may 3-6 m (10-20 ft) and for medium trees 6-9 m (20-30 ft).

Period required for fruiting. These trees and shrubs may again be grouped according to the period within which they can start bearing fruit from the date of planting.

| | |
|---|-----------|
| Banana, currants, gooseberry, grapes, <i>karonda</i> , papaya, <i>phalsa</i> , pineapple, raspberry, strawberry, tomato | 1-2 years |
| Citrus, custard apple, fig, guava, litchi, mango, peach, pomegranate | 4-5 years |
| Apple, plum, pear | 6-7 years |

Fruits in different months. The period of fruit availability with specific reference to north Indian conditions and northern hills is as follows:

| | |
|-----------|--|
| January | <i>Aonla</i> , gooseberry, guava, <i>mosambi</i> , orange and raspberry |
| February | <i>Aonla</i> , <i>ber</i> , gooseberry, orange, raspberry |
| March | <i>Ber</i> , papaya |
| April | Strawberry, tree tomato |
| May | Apricot, cherry, fig, litchi, peach, plum, <i>phalsa</i> , tomato |
| June | Apricot, grapes, litchi, mango, mulberry, peach, pear, <i>phalsa</i> , pineapple, plum, pomegranate, tree tomato |
| July | Mango, mulberry, pear, plum, tree tomato |
| August | Apple, guava, lemon, pear, lime, mango, tree tomato |
| September | Apple, guava, lemon, lime, pear, tree tomato |
| October | Apple, custard apple, pomegranate, tree tomato |
| November | Custard apple, grape fruit, guava, <i>mosambi</i> , orange |
| December | Grape fruit, guava, <i>mosambi</i> , orange |

For planting a small kitchen garden with fruits and vegetables, the designs given in the previous chapter may be helpful. More detailed description has been given in respect of fruits which enjoy special importance or utility in the home gardens, namely, banana, grapes, papaya, peach, pineapple, strawberry and tree tomato.

BANANA

(*Musa paradisiaca*; Hindi: *Kela*)

The banana is a tropical plant and thrives best in moist and hot regions. In north-west India it is adversely affected both by dry heat and frost.

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The banana is quick growing and requires fertile and well-drained soil. It can be easily propagated from suckers. Select the healthy sword suckers about 45-60 cm ($1\frac{1}{2}$ 2 ft) high. Water suckers should not be planted as they produce weak plants.

All suckers which are produced before the plant bears fruit should be removed to divert the nutrition to the fruit. Not more than two suckers, one older by about 4 months than the other, should preferably be retained in a plant thereafter. The plant which has once fruited does not bear fruit again and should be cut off after fruiting. Removal of green leaves of the mother plant is said to affect the size of bunch.

A sucker would bear flower in about 8-12 months of planting and fruits will take another 3 months to be ready. After the fruit is fully formed, remove the cone shaped part of the inflorescence which grows from the heart of the bunch. The bunch should be cut off from the plant when fruits are fully developed but still green. A stalk of about 25-30 cm (10-12 in.) may be retained at the base. This reduces 'bleeding' and prevents early rotting of fruits. It is recommended that smearing the cut with vaseline or melted paraffin reduces 'bleeding' and keeps the fruits longer and gives better colour. I have usually applied slaked lime at the cut end.

For a small home garden it is a good idea to have a plant for table purposes and another for cooking purposes. As a raw fruit, it makes excellent chips, vegetable cutlets and chops, boiled and ordinary vegetable also. The tiny yellow flowers of the cone-shaped inflorescence make excellent vegetable chops when boiled and mixed with boiled potato, though it is a cumbersome process to separate them.

Table varieties. *Eastern India* — 'Amritsagar', 'Champa', 'Malbhog' and 'Martaman'; *Maharashtra and Western India* — 'Basrai', 'Champa', 'Harichhal'; *South India* — 'Poovan', 'Martaman' (Rasthali), 'Nendran', 'Manthan', 'Robusta'. 'Co. 1', a fine synthetic hybrid, bred for the first time in India by the Tamil Nadu Agricultural University, is reported to be suitable for the hills and the plains. It takes $14\frac{1}{2}$ months from planting to the fruit ripening and gives about 10.5 kg yield with 7 hands.

Cooking varieties. 'Bontha', 'Batheesa'.

CITRUS FRUITS

The popular fruits in this group are lemon, lime, malta, *mosambi* and orange. Technically, an orange includes a malta, *mosambi*, *satgudi* and loose jacket orange known as mandarin orange. Grapefruit, pummelo and sweet lime are also included. Of late, a mandarin orange 'Kinnow' has become very popular in the Delhi suburbs, Haryana and Punjab. The citrus fruits are of tropical to sub-tropical origin but are quite adaptable and grow conveniently up to 1,200 m (4,000 ft). There are some species which do well up to 2,000 m (6,500 ft). They grow in dry as well as heavy rainfall areas like Shillong but require watering in dry places.

The lime and Assam lemon flower throughout the year. Most of the others have two flushes. These plants are evergreen and gross feeders and are practically active

throughout the year. They have feeding roots near the surface and it is recommended not to dig more than 10 cm (4 in.) around the trunk. No intercrops, therefore, are also recommended after the plants have come into fruiting. In the Jaintia Hills of Meghalaya, ginger and turmeric are grown as intercrops with the oranges. These intercrops are heavy feeders and feed at the same level as the feeding roots of oranges and this practice has been scientifically stated to be unsuitable. An area of 30 cm (1 ft) around the tree is recommended to be kept undisturbed. A basketful of about 30-40 kg of farmyard manure initially at the time of making a pit for a new plant and subsequently 10 to 40 kg additional manure annually depending on the size of the plant would be required. It should preferably be given in two doses — in September before the onset of the winter and before the beginning of the rains in May-June.

The lichen and mosses develop on citrus trees in high rainfall areas like Shillong and it is tempting to put orchids on them. It is, however, recommended that the trees should be kept free of them.

One of the worst and very common diseases is the dieback. It is caused by a fungus. The citrus decline is caused by various factors of malnutrition, virus, fungus, bacteria or pests. It is engaging attention of various research groups. The other major diseases are gummosis (fungal), greening (viral) and canker and scab (bacterial). Leaf miner, citrus butterfly and citrus psylla are major pests.

The tree trunk up to 60 cm (2 ft) should be washed with lime annually with the onset of winter season and also early summer. Application of Bordeaux mixture or any commercial copper fungicide is also recommended.

The citrus fruits are normally propagated by seeds as well as by budding. For home gardens, it will be advisable to buy the budded plants. They do well in open sunshine. No pruning is required except for shape or removal of dead or diseased twigs. The branches should be allowed to be developed only after 30 cm (1 ft) from the ground. The trees are small and a spacing of 5-6 m (17-20 ft) between two plants would normally suffice. Local varieties as suitable may be grown.

GRAPE

(*Vitis vinifera*; Hindi: *Angur*)

The grape is a fruit of subtropical region. The fruits get spoiled if it rains before the harvest. The plant grows well in the hills but generally receives a set-back due to summer monsoon, and the fruit becomes insipid or sour in the hills with heavy rainfall. The distance between two plants varies with the variety. The dwarf varieties like 'Beauty Seedless' may be planted 180 cm (6 ft) apart, medium varieties like 'Pusa Seedless' may be 2½ m (8 ft) apart and more vigorous varieties like 'Anab-e-Shahi' may be 3½-4 m (10-12 ft) apart.

Vines must be trained from the beginning. There are three systems in vogue. A

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common feature of all of them is a single stem at the base with no side shoot on it. The variation is mainly in the height of the stake and the growth of lateral branches. The details are:

(1) As a standard with a single stem of about 1 m (3 ft) and branches radiating at the top as in 'Beauty Seedless';

(2) As a single stem with lateral flowering shoots trained on a wire or bamboo trellis, called 'Cordon System' as in 'Pusa Seedless' and 'Thomson Seedless';

(3) As a bower with a tall single stem and overhead flowering in a bower called 'Bower System' as in 'Anab-e-Shahi'.

At the time of pruning the main shoots are cut back to 6-9 eyes in the laterals in systems (2) and (3). In system (1) shoots are cut back to 3-4 eyes.

In north India and the hills, the plants remain dormant from December to March and give a single crop. In north India it is pruned only once in late January or early February; in the hills in early March. In south and west India two crops are taken, and pruning is done twice in the months of May and October. Leaves are defoliated before pruning. Sometimes even 5 crops are taken in 2 years by regulating the pruning. This might, however, affect the vitality of the plant in the long run.

Grapes should be harvested when fully ripe. They do not ripen after harvesting. All bunches do not ripen simultaneously. Picking may continue for 1-3 weeks. A bunch is ready for picking if berries change colour and get soft and sweet. Clip the bunch with a pair of scissors. Sometimes it is necessary to thin out grapes to obtain uniform berries.

Varieties. South and West India — 'Anab-e-Shahi', the most popular variety of Hyderabad; 'Bhokri', 'Kali', 'Sahebi', 'Bangalore Blue', 'Cheema 7', 'Muscat Hamburg'; *North India* — 'Beauty Seedless', 'Pusa Seedless', 'Perlette', 'Thomson Seedless', 'Bhokri', and 'Cardinal'.

For pot plants or very small gardens I would strongly recommend 'Beauty Seedless' variety which matures early — from May end to June early — while the other varieties in north India mature from the second week of June onwards. It takes less space and can give a good yield of 10-15 kg per plant. It bears sweet dark-purple fruits. 'Pusa Seedless' and 'Thomson Seedless' are also suitable for small gardens.

PAPAYA

(*Carica papaya*; Hindi: *Papita*)

Papaya is a tropical plant with ornamental foliage. A plant laden with dark-green fruit, pale-green and leafless trunk and bright foliage at the crown is very attractive. The fruit can be used raw as a vegetable and when ripe as dessert. It is a rich source of vitamin A.

The papaya adapts itself to subtropical areas also provided they are frost-free. It is reported, to grow up to about 600 m (2,000 ft) above sea level provided the place is frost-free.



142. A dwarf ornamental bamboo



143. A coconut (*Cocos
nucifera*), a tree of life



144. A loose jacket orange (mandarin) tree

Pick fruit when fully developed but green and lay it on soft straw to ripen. It is sometimes necessary to thin out some fruits to prevent over-crowding. It gives fruit all the year round under mild tropical conditions. Peak period of fruit ripening is spring in north Indian conditions.

Papaya can be grown only in light loamy soil. Drainage is very essential, water-logging may cause collar-rot. Earth up the base of the tree and drain off excess water.

The papaya is propagated through seeds. Select seeds of a sweet fruit with good flavour, in the absence of seeds of a recognised variety.

The seed may be sown any time during summer. They germinate in about 3 weeks. The seedlings when 15-20 cm (6-8 in.) high may be transplanted in pits 60 cm (2 ft) diameter after about 2 months, in the beginning of rains or earlier, depending on irrigation facilities. The papaya starts bearing fruit within a year of transplanting. The life of a tree is about three years. It may continue to give fruits thereafter, but the yield will be poor and the quality may also be affected. Another practice recommended is to plant new trees every year. The tree remains dwarf and is said to give the best yield.

It is better to plant two seedlings per pit. As soon as the buds appear, male plants should be removed leaving only 5 per cent of male plants needed for pollination.

Due to the plants being propagated by seeds, there are no distinct and true varieties. However, a few which are comparatively known to be stable are 'Co. 1', 'Co. 2' and 'Coorg Honey Dew'. 'Pusa Giant' with big fruits (2.5-3.5 kg) is recommended as suitable for areas where the wind velocity is high. 'Pusa Dwarf' bears fruits when the plants are only 25-30 cm (10-12 in.) from the ground. All these varieties have separate male and female plants. There are new varieties available which bear flowers which are bisexual or female, like 'Pusa Delicious' and 'Pusa Majesty'. Certain Hawaiian varieties like 'Solo', 'Sunrise Solo' are also bisexual.

PEACH

(*Prunus persica*; Hindi: *Aru*)

The peach, a temperate fruit, normally grows at lowest elevations in the hills from 750-1,500 m (2,500 to 5,000 ft). Some varieties can also be fully cultivated in subtropical plains. Such varieties grow well in the western U.P., Haryana and Punjab plains also. It bears lovely blossoms in shades of light pink to deep rose-crimson in January-February. It is one of the earliest temperate fruits. It bears fruits on one-year-old shoots. The bacterial leaf curl is its main enemy. Another disease to which it is quite susceptible is mildew. Fruits need thinning.

The peak season for fruiting is May-June. It may continue up to July. The tree starts bearing fruit from 4-6 years in the hills, and in the plains the varieties recommended below in the third year.

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The variety 'Flordasun', a recent introduction from the USA, is a prolific bearer at lower altitudes. It is an early variety and has shown resistance to leaf curl disease. There is another variety, 'Sharbati', which is also very suitable for the subtropical plains.

PINEAPPLE

(*Ananas comosus*; Hindi: *Ananas*)

The pineapple is a tropical fruit and grows best in a hot and moist climate. It is successfully grown in moist conditions in the low hills also up to 900 m (3,000 ft). The pineapple with variegated leaves is used as an ornamental house plant.

The pineapple requires a well-drained, porous and light soil. It does well on slopes. Pineapple does not like direct exposure to sunshine and light shade is helpful. Heavy shade, however, is harmful.

It can easily be propagated from suckers taken in August-September when new suckers/plants are ready. Leave the sucker in a cool dry place for 3 days to enable it to form a hard callus. It is liable to rot if planted fresh. Propagation is also by the crown, i.e., clusters of leaves on the top of the fruit or a slip taken from the peduncle near the base of the fruit. In some countries like Hawaii, a slip is preferred to a sucker or the crown.

The plant bears fruit within one year of planting of the sucker. The fruits take about three months to ripen after flowering. Cut the plant which has fruited. Retain only one or two suckers. If two suckers are retained, retain, the sturdier one and remove the other after some growth.

The plant attains the height of 75-90 cm ($2\frac{1}{2}$ – 3 ft) and the interval between two plants may be 30 cm and between rows 60 cm. The peak fruiting season is June-July.

Varieties. 'Giant Kew' and 'Queen' are two most popular varieties. 'Giant Kew' fruit is large massive, yellowish-green and cylindrical and its leaves have no spines. This is more popular for the processing industry. 'Queen' fruit is smaller, yellow to golden, oval and more tasty. This is more popular for table purposes. There is another variety 'Mauritius' with reddish-yellow colour fruit which is larger than 'Queen' but is not so tasty.

STRAWBERRY

(*Fragaria vesca*)

A soft luscious fruit tempting for its colour, taste and flavour. It is excellent for dessert as well as jams. It is a fruit mainly of the temperate region, but there are varieties suitable for the subtropics and some have acclimatized in the plains also. In the plains heavy thatch shade is required.

Propagation can easily be done by runners. Best time for planting is September-

October when the runners are ready.

Fruiting is from March to middle of May in the plains and in April-May in the hills for 4-6 weeks. All runners not required should be removed. It is recommended for the temperate region by some writers that the first year blooms should be removed and the fruits should be taken only from the plants older than one-year. My experience, however of growing strawberries in Shillong at 1,500 m (5,000 ft) was that the runners planted in September gave excellent fruiting in the next season. They gave very good yield for the second year also. The yield started deteriorating from the third year onwards. Some gardeners have, however, reported that the peak yield is during second and third years. The performance may, therefore, depend on the variety as well as the location. But in every case, there is decline in the yield after 3 years and the plants should be discarded after 2-3 years. It is worthwhile keeping two or three plots for rotation, one of them containing new runners and the others older ones.

In the plains, the plants bear fruit for one season only. They have, therefore, to be cultivated afresh for the next season from the runners.

Dig soil up to 30 cm (1 ft), break up thoroughly and firm it lightly. Strawberries do not like spongy soil. Insert the plant so that the crown, i.e. the top leaves of the plant is just out. The spacing between two plants may be 45 cm ($1\frac{1}{2}$ ft) and there may be 3 rows in a bed staggered in a triangular pattern in a bed. Surface roots should not be allowed to become dry. Regular watering during flowering period is essential.

Birds are a nuisance and wooden frames covered with chicken wire was found effective. The birds net like a fisherman's net made of jute strings (*sootli*) is also used to cover the plants.

A healthy plant in the hills may give as much as 1 kg with an average of half a kg and in the plains $\frac{1}{4}$ kg.

Some of the recommended varieties are 'Royal', 'Sovereign', 'Shasta', 'Tyoga' and 'Dil Pasand' for the hills, and 'Pusa Early Dwarf' for the plains.

TREE TOMATO

(*Cyphomandra betacea*)

A pretty tree, it thrives well in the hills, from 800-2,000 m (2,500-6,500 ft). The orange or orange-red, oval-shaped fruits borne in clusters at the ends of young branches look very attractive during the rainy season and it is in fruit mostly when the other tomato is not in the market. The leaves are thick and hairy. The flowers are fragrant. The fruits can be used as a substitute of the other tomato for cooking purposes but are not good for table purposes. They are also excellent for jams, jellies and *chutneys*.

This small tree, height $2\frac{1}{2}$ -3 m (8-10 ft) with spacing between two plants of 2-3 m (7-10 ft) deserves to be popularized extensively in the hills. It can grow well in any well-drained garden soil in a sunny position. Can be propagated easily from big hardwood

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about $\frac{1}{2}$ m cuttings planted in March-April. It is also raised from seed. It begins to fruit in the next year after planting the cutting. No pruning is normally required. There is no recognised variety. There are varieties which will give fruit from April to September. A plant may give as much as 15-20 kg of fruit. It needs protection from frost during severe winter.

SPECIAL FEATURES OF GARDENING IN THE HILLS

FLOWERS, vegetables and fruits can be grown in very wide range of varieties, colours, sizes, shapes in the hills in India throughout the year except the period the area is snow-bound. Plants suitable for temperate climate can be grown successfully.

Cultural notes on growing of flowers, vegetables and fruits in the hills have been given in the respective chapters. Certain special features of gardening in the hills need reiteration.

(a) Longer cool period helps in development of large and succulent vegetables and fruits. The colours of flowers are deeper and the plants are more bushy and taller than the same plants in the plains.

(b) Plants are more particular about their situation. Those which are sun-loving, will not do well along the north wall. The plants in the plains are not so particular. The sun-loving plants in the hills should be cultivated in rows running north to south.

(c) The frost is more severe and is extended over a long period in the hills. Therefore, instructions regarding watering, storing and protecting the plants from frost are more important. Cultivation of frost-resistant plants known as 'hardy' plants is more essential in the hills. The valleys are more frost-bound than the tops or slopes of the hills.

(d) Winds are generally stronger in the hills and therefore more protection is required. Stronger stakes and wind barriers are a necessity. Hill tops are more exposed to strong winds.

(e) In the plains, as the period available during winter to the plants for their growth is short, more recourse to liquid manure and artificial manure is helpful.

(f) Glass-houses are more helpful in the hills though they have not yet become common in India. The plains will require greenhouses with air-conditioning equipment to reduce the temperature. These are more costly than the ordinary greenhouses in the hills which need not have sophisticated air-conditioning equipment.

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(g) The soils are likely to be more acidic in the hills. *Azalea* and *Rhododendron* are known as lime-haters while normal garden crop of vegetables and fruits would require lime, once a year on the other hand.

(h) On the whole the time taken for maturity of a plant is more in the hills than the plains.

(i) The plants which behave as annuals in the plains may be biennials or perennials in the hills. The bulbous plants do extremely well in the hills and are a great source of colour and delight. Drifts of daffodils dancing by the river-side are enchanting.

19

FLORAL ARRANGEMENTS

FLORAL arrangement means an arrangement of fresh or dried plant material in a pleasing manner. The arrangement may be of flowers, fruits, flowering shrubs and evergreen plants for interior decoration, or of flowers and foliage as personal decoration. It may be for special occasions as garlands, bouquets or button-hole decorations.

When the interest in flower arrangement is merely because it is in fashion and, therefore, must be cultivated, it does not grow beyond its limited objective. But when it is awakened by the exciting and tender forms of new leaves, variegated shades of foliage, hues of stems and barks, forms of berries and fruits, colours, sizes and shapes of flowers, it becomes a living interest and grows like the hunger of a gardener. I find the leafless floral shape of the Temple Flower Tree (*Plumeria acuminata*) in the month of January-February as one of the most exciting shapes. Its smooth, round greyish-brown branches, beautifully arranged, beat any 'Ikebana'. I mention this fully knowing the opposite view of some that this tree is 'gouty' and 'ungainly'. Again, the spiky leafless chestnut-coloured plant of *Bursera* shining in the morning light makes a fascinating figure.

The stylized flower arrangement tends to become stereotyped and stale. But the natural arrangement is as diverse as forms of plant growth in nature. It is sometimes spread out like the *gulmohar* (*Delonix regia*), sometimes compact like *Kochia*; sometimes low like Livingston Daisy (*Mesembryanthemum*) or *Tagetes signata pumila*; sometimes high and erect like the hollyhocks; sometimes over-flowing like *Zebrina* or *Tradescantia*; or sometimes prim and formal as the palm *Licuala grandis*. No painted stems, twisted twigs, trimmed leaves or steel wires can capture natural grace of a twig or the sweep of a natural colour. This, however, is a controversial issue and best be left to the person making the flower arrangement. If she finds self-expression in the stylized arrangement, I have no dispute.

STYLES – WESTERN AND JAPANESE

The two main popular styles of flower arrangements are Western and Japanese.

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With limited and costly supply of flowers and plant material, the Japanese style has an advantage over the Western one. Some of the Western arrangements exhibited in the flower shows at Delhi look like massacres of flowers; they are crowded so closely that the flowers look as if unable to breathe. I wonder whether any flower lover would have the heart to pluck so many flowers at a time from his garden. The Japanese style has various categories, groups and sub-groups and treatises have been written on them. The 'informal' category in the Japanese style allows greater freedom of expression.

General principles. The general principles of floral arrangement are derived from the general habit of growth of the plants in nature. Some of them may be stated as follows:

1. Colour harmony: Colours may match or contrast, but not clash as in the *Bougainvillea* 'Dr R.R. Pal' the bright magenta of the bracts contrasts beautifully with the white of the true flower, while the soft pinkish off-white colour of bracts gently blends with the pale greenish-cream colour of the true flower in 'Lavender'.

2. Blooms on plants are more open in the lower portions than in the higher ones. In a spike, the flowers gradually open from the lowest to the topmost bloom. Hence, the principle that the big and more open blooms are at the bottom, medium-sized ones at the middle and the least open ones at the top. An exception to this principle may be with regard to the drooping spikes where the flowers open from the top downwards.

3. The branches or shoots never meet each other in vertical or horizontal lines. Similarly, a number of shoots meet the main branch at different intervals. Hence, in an arrangement, the flowers and other plant material are arranged at different angles with each other, but never at vertical angles.

4. An arrangement shows itself off better with a base which may or may not contain water depending on the type of arrangement. The arrangement must be in proportion to the base. When a container is used, normally the length or width of the arrangement should not be more than $1\frac{1}{2}$ -2 times that of the container. It can be stretched up to $2\frac{1}{2}$ times if properly balanced.

5. An informal container, like an informal flower bed in a garden, looks more natural than a formal one. A container which distracts attention from the arrangement is going beyond its assigned function.

6. Normally it is advocated that the number of flowers or leaves used should be an odd one for an effective arrangement. I should think that there is no hard-and-fast rule about it as no such rule exists in nature.

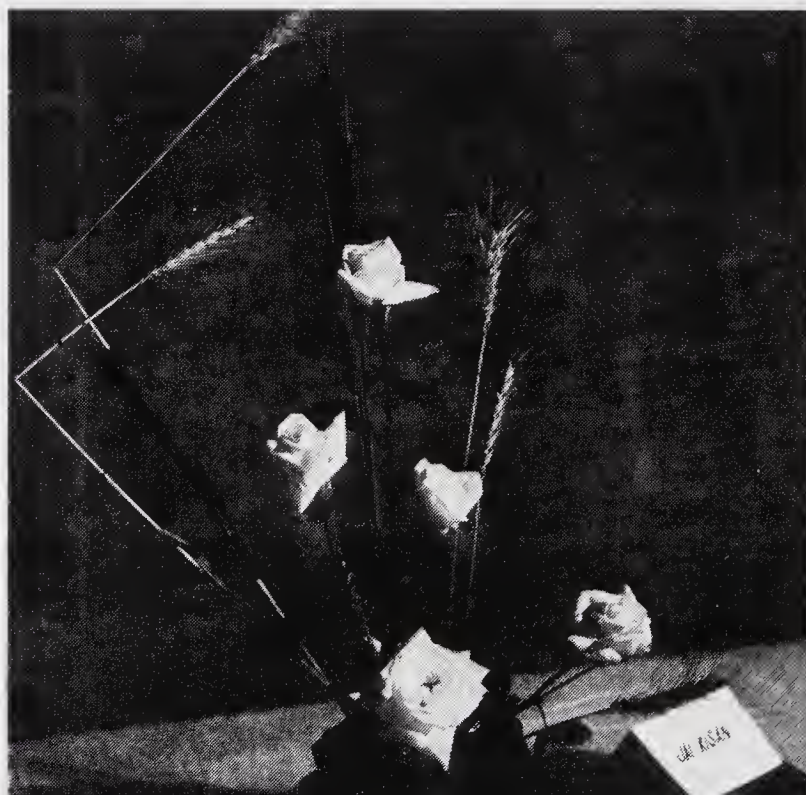
7. The blooms in nature may be wind-swept; but would seldom be looking as if they are falling backwards or forwards. Therefore, the arrangement should be such that it should not give an impression as if the material could not be secured in its position. An arrangement which gives the real feel of 'wind-swept blooms' looks very attractive.

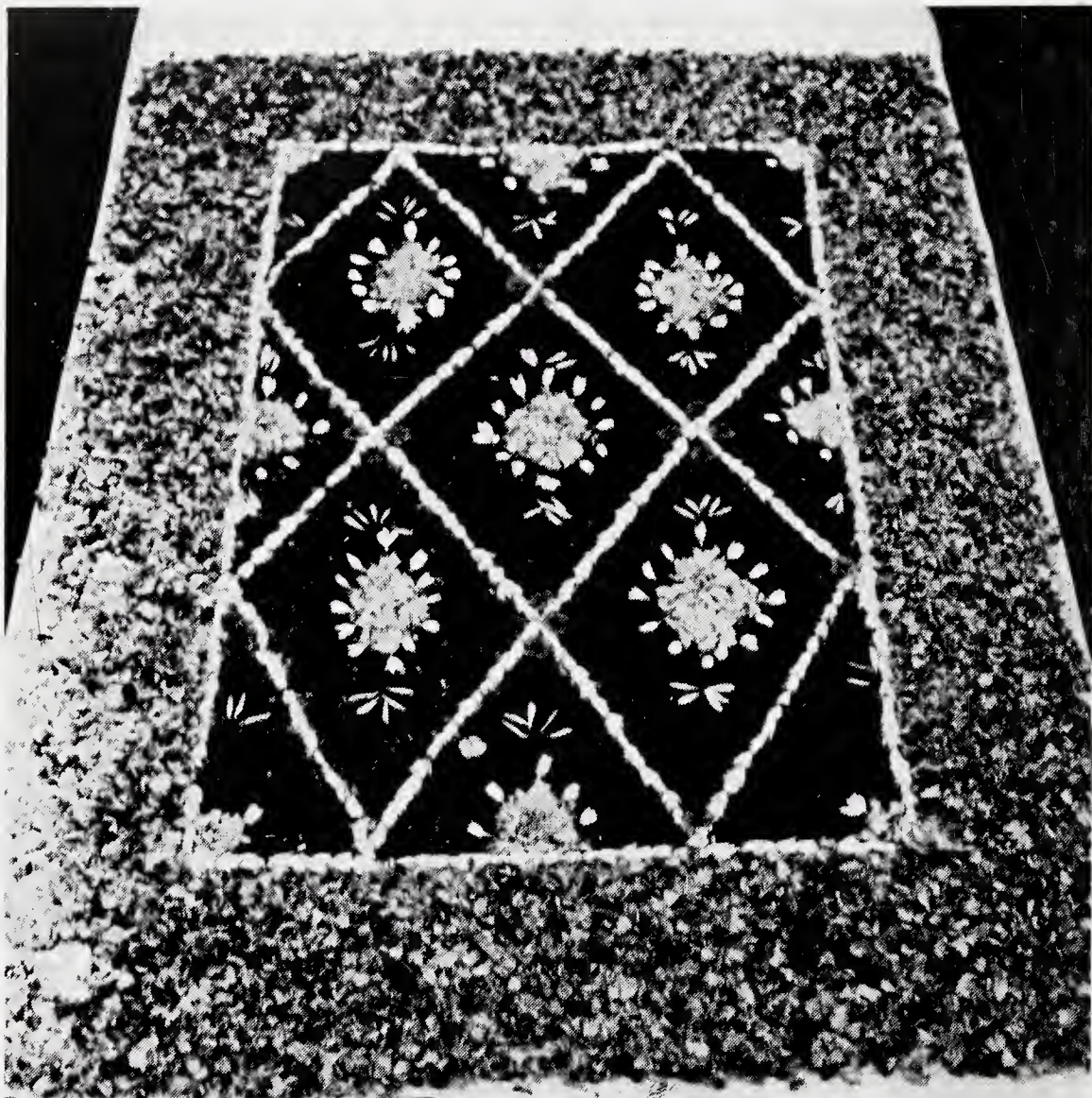
Anybody who has been to the hills must have noticed that flowers lurking through stones look very pretty. On the barren hills on our way to the Rohtang Pass in Himachal Pradesh, we noticed sprays of violet-coloured *Iris* blooms, *Iris nepalensis* exuding

145. A heart-warming
floral arrangement

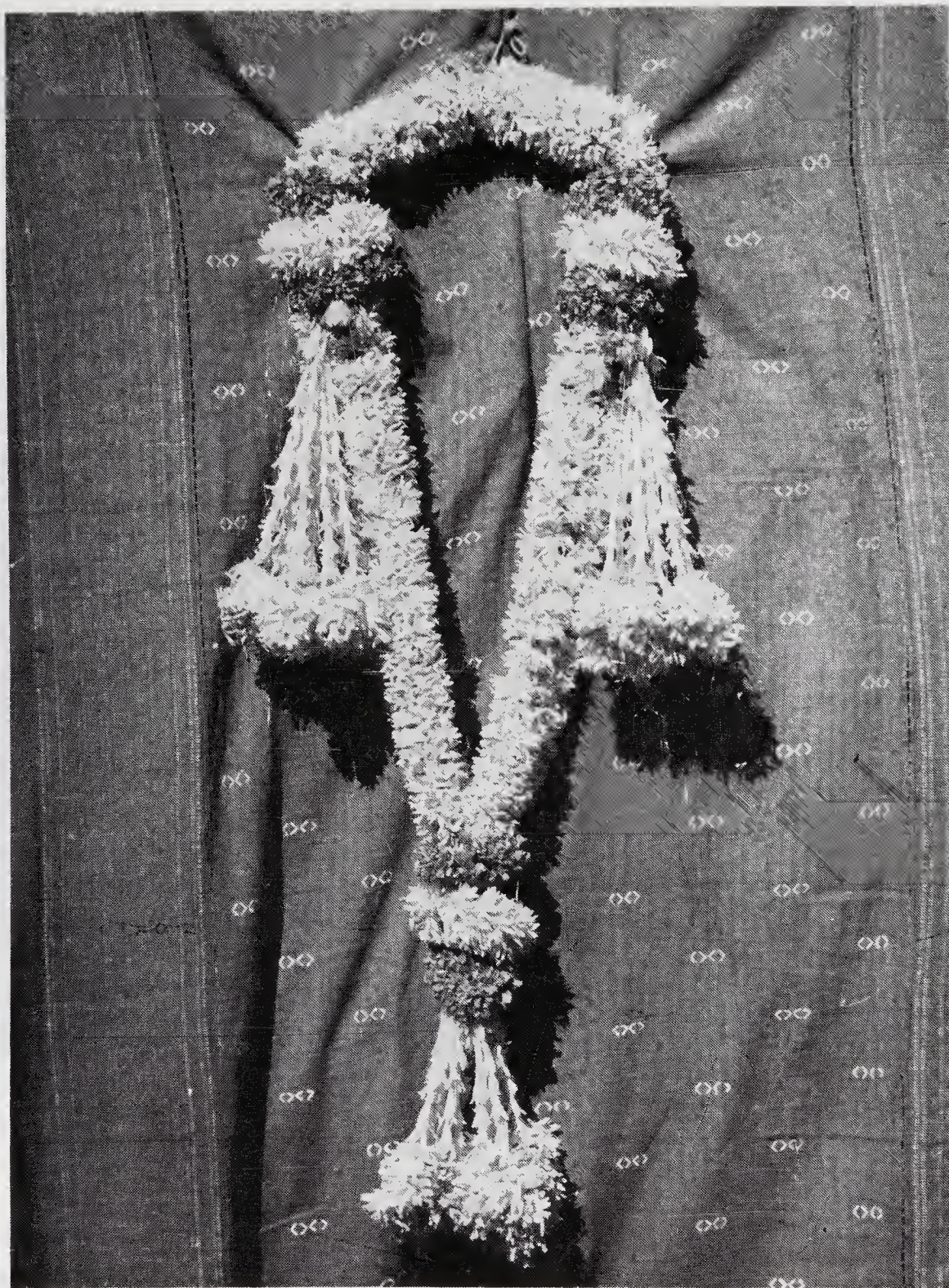


146. Another attractive
floral arrangement

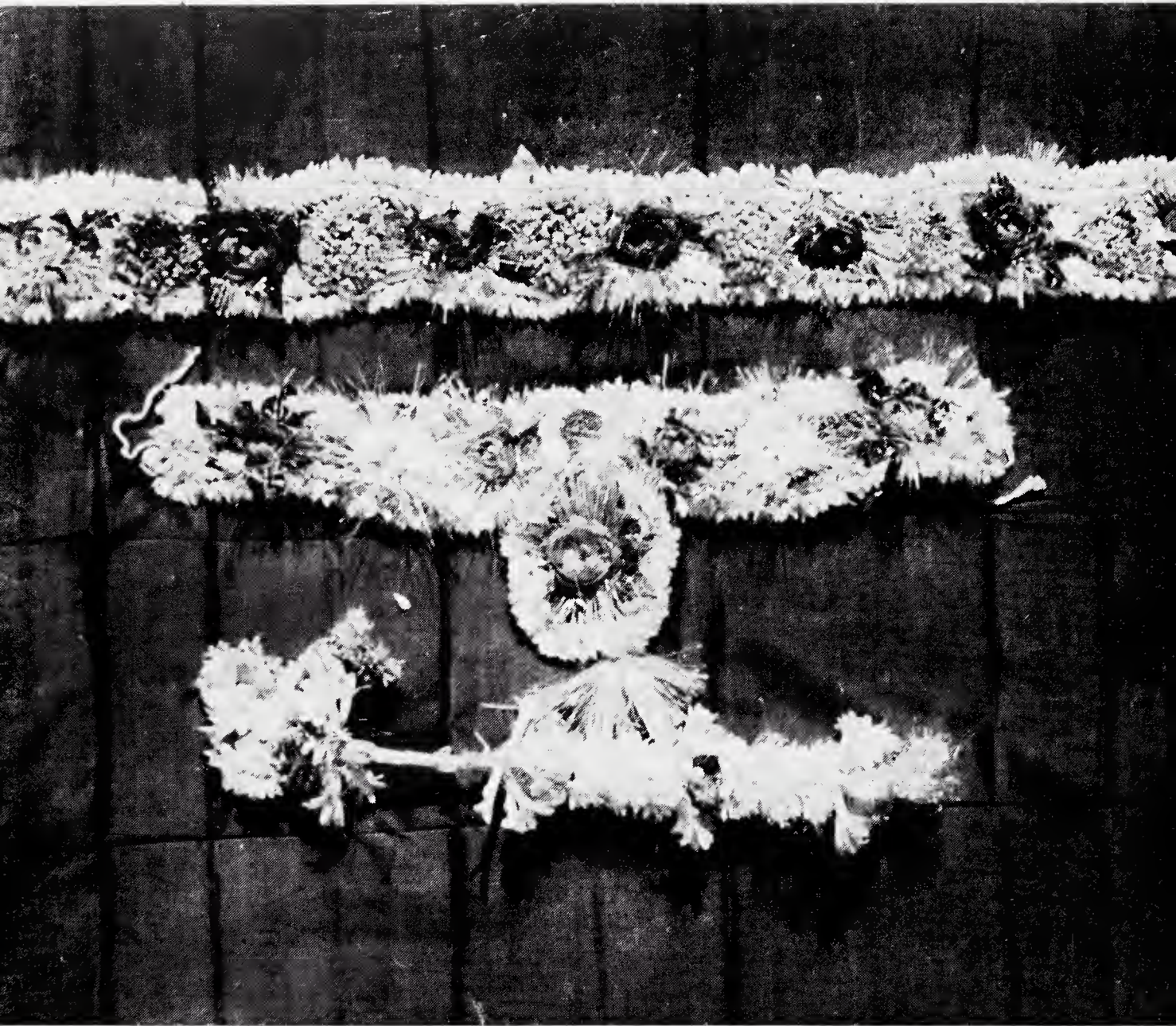




147. A 'Rangoli' of flower petals



148. A flower garland



149. Flowers as decorations for hair, hand, forehead, etc.

fragrance all over the place. Flowers can thus be arranged beautifully in combination with stones. A mistake sometimes made is that river stones are used to give an effect of the hills.

Accessories. Accessories for flower arrangement would include a small sharp pair of secateurs, an array of containers, pin-holders of different sizes, small bits of chicken-wire to position in plant material for root plants, and a small hammer to break the edge of the woody branches.

FLOWERS FOR SPECIAL OCCASIONS

Women using 'veni', i.e. a band of flowers in their hair, look charming. In south India, it is a pleasant sight to see every woman wearing flowers whether she goes to school or office, or stays at home. Pandit Jawaharlal Nehru's red rose in his button-hole has set an example for men. A carnation or orchid is another favourite flower for a button-hole. Besides being beautiful, they have excellent keeping quality. No decoration for Indian dances is complete without flowers.

Use of flower petals in religious festivals is common. But its modern version is 'rangoli', a colourful carpet of petals of different colours, shades and hues beautifully blending with each other. Such an arrangement can be effectively made on the dining table or in the centre or corner of a sitting room. A keen competition takes place for this item in the Delhi flower shows.

I am thrilled to see the 'vedis', i.e. a square place where Hindu marriage ritual is performed, decorated with white jasmine and red roses. It is fragrant, it is beautiful and it is significant. It carries blessings of purity, happiness and fame. The bouquet of white flowers used in Christian marriages is unique for its dignity. A tuberose garland is a gorgeous sight even though it means losing so many blooms at a time. It has also the quality of remaining fresh for a long time even in that condition. Another flower which is unbeatable for its keeping quality as a garland is the marigold. A beautiful decoration of marigold in different hues of yellow, orange and brown was seen by me in the forms of hanging lanterns at a marriage. They are also used as stage decorations. A bridal chariot and its modern version the bridal car is not considered ready unless it is bedecked with flowers all over. Now-a-days a roaring business exists in Delhi of the sale of flowers. One wishes, however, that more varieties were readily available and that this nature's gift is not over commercialized.

20

EXHIBITION AND RESEARCH

AN exhibition of flowers, vegetables and fruits has the advantage of showing at one place the best of a very large number of varieties cultivated in an area. New introductions are also proudly displayed side by side the prize-blooms. In some exhibitions, there is a separate section or recognition for new introductions. A visit to such an exhibition is a treat as well as an education.

EXHIBITION

Before exhibiting, it is better to visit a show at least once to get an idea of the quality exhibited. It is also helpful to discuss with a friend who has successfully exhibited, preferably in that show. In a show, you may exhibit cut-flowers, vegetables, fruits, pots, hanging baskets or a garden — flower garden, kitchen garden or garden as a whole — as included in the rules.

General conditions of exhibiting. One of the important conditions of exhibiting is that the exhibit must be grown in the exhibitor's own garden. If you have five blooms and the sixth one which was all right till yesterday has suddenly faded, the temptation to borrow a bloom from a friend is great, but is not permissible. The rules for exhibiting provide for a minimum period, the plant should be in the exhibitors' garden before he can exhibit. This must be observed. The last date for entry should be carefully noted. In some shows, entries are accepted after the last date on payment of double entry fee. Gardens and pot plants are judged on days different from the day of the show. In case of garden entries, even on payment of the late fee, the entry after the last date is generally not accepted.

Not naming an exhibit sometimes, amounts to a disqualification. Disqualification generally arises due to negligence, lack of knowledge of rules or a last minute mistake due to hurry. These are avoidable. Any compromise with integrity with a view to

winning is poor in taste and what is worse for the exhibitor is that it is easily seen through by the others.

Exhibiting a garden. To exhibit gardens, preparation for at least 2-3 years is necessary. A good flower garden should have a combination of annuals, perennials, flowering shrubs, climbers, pot plants, besides a lawn, a compost pit and a working shed or corner for potting material and storing for seed and implements. Officers on short-duration postings should generally avoid competing in this class. I know of an officer posted to a district, who having a huge garden of over an acre, competed within six months of his posting. He did very well in annuals but got only a compensatory prize for the garden entry because his garden lacked a number of these permanent features. He, naturally, was heart-broken.

A good garden as a whole should have a balanced combination of a flower garden with vegetables and fruits, trees and shrubs. The vegetable and fruit plants should be such as to supply fruit over a long period. A variety of attractive garden features may lend uniqueness to a garden.

For competing in kitchen gardens, vegetables should be at their best, with a combination of vegetables of different categories, namely, roots, beans and pods, cucurbits, leafy vegetables, together with herbs. The vegetables should be laid out according to a plan as discussed in Chapter 16.

Exhibiting pot plants. In pot plants, the plant should have been grown in the pot. A plant, lifted from ground and shown in a pot, is liable to disqualification. A weak, straggling, ill-balanced plant, carrying insufficient flowers or having unhealthy, damaged or blemished foliage is unsuitable. Smallness of a plant for its type is also a disadvantage.

The pots should not be painted with any wood or oil paint, but only coloured with red earth popularly known as 'gerua'. On all pots reference number of the exhibitor should be written with a piece of chalk or in black paint as required in the rules as sometimes the volunteers mix them up in arranging. If any stakes and tying material are retained, they should preferably be painted green to let them merge with the foliage of the plant. In foliage plants, no grease or oil should be used.

Diameter of a pot is the inside measure nearest to the top, but not including the rim. Diameter of the pot is generally laid down in the rules of the show.

In a group, plants should harmonize with each other, in colour and size and with the background. An interesting device sometimes adopted by exhibitors is to bury the pot into the ground by a few inches if a plant in a group is slightly tall or to heap soil underneath to raise it if it is slightly short.

In showing a cactus or a house plant, other things being equal, its rarity or difficulty in growing or its being in bloom are additional qualifications.

Exhibiting cut-flowers. In cut-flowers, foliage as well as the bloom is seen. General qualities which are checked are uniformity, condition, colour, size, form, stem, etc. Uniformity is important as one large flower among other smaller flowers or *vice versa* will

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affect the quality of the entry. It must be fresh and bright in colour; size should be big for the type. It must be of good form for the type, e.g. a Pompon *Dahlia* should be compact and not show its heart; the spacing in an *Antirrhinum* spike should be uniform. The stem should be strong and erect. *Salvia* has a tendency to droop. Be careful in handling it. In exhibiting a spike of flowers, like *Gladiolus*, the first flower should be fresh and maximum number of flowers should be open. In a spike or spray all dead and blemished flowers or foliage should be removed, as far as possible. The flowers which show a tendency to a split calyx as in carnation or to an 'open' heart as in a rose, can be aided to some extent by a piece of wool loosely tied around it. The piece of wool is removed just before exhibiting.

Containers for cut-flowers are generally provided by the organizers. To keep flowers fresh and also to fix them in the desired position, a little moss or cut leaves may be added to the water. The flowers may be arranged keeping in view the background colour of the wall. Clashing colours should be avoided in a container. Overcrowding in the container should similarly be avoided.

A long stem is generally a qualification, but it should be proportionate to the size of the container. I once saw a *Crinum* entry losing to another one because its stem was disproportionately large and the entry did not look as appealing as the other one which had a stem proportionate to the flower as well as the container.

The exact number of specimens required in the schedule should be displayed. Sometimes a distinction is made between a stem and a bloom and an entry may be disqualified by the exhibitor not understanding the difference, e.g. a marigold bloom will mean a single flower on a stem, but a stem will allow a number of flowers on it.

Flowers, vegetables or fruits should be cut in the early morning or late in the previous evening, for the show. Immediately after cutting the flowers, their stem should be immersed up to the neck in a pail of water and about 1.3 cm ($\frac{1}{2}$ in.) of stem should be cut off inside the water. The flowers should be transferred to the vase just before the exhibition opens.

Flowers droop because air goes into their stems and moisture evaporates. One of the most successful ways to revive such flowers is to dip the stem in boiling hot water. A bubble or two will be formed in the water by the air expelled by the flower. Care should be taken to cover the flower with a piece of cloth, so that it is not exposed to direct heat of the boiling water or the fire. It should immediately be immersed in very cold water up to its neck.

The stems of flowers which 'bleed' or exude milky juice when cut, like *Poinsettia* or *Euphorbia splendens*, should be buried in warm ash for a few seconds. This seals the cut, stops its bleeding and keeps the flowers fresh for a long time.

The ends of the woody stems, about 3-5 cm ($1\frac{1}{2}$ -2 in.) of plants like pines used in floral arrangement may be lightly crushed or divided into 3-4 parts. This improves its moisture-retention capacity and also provides a better balance for the arrangement.

It is sometimes recommended that the cut-flowers can be kept fresh by adding a

little aspirin or salt or sugar to the water. It is better to try out these treatments before the show and not experiment with the exhibition blooms.

Exhibiting fruits. For exhibiting fruits, unless otherwise stated in the rules, all fruits should be ripe. Over-ripeness, malformation, decay, cracking, blemishes, bruises or other injuries and small for its type, are defects. Other things being equal, specimen of bigger size are at an advantage. Uniformity, superior flavour, succulent texture, juiciness, colour appeal are some of the qualities.

Exhibiting vegetables. The vegetables to be exhibited should also be uniform in size, colour and form, bigger size for the same type and in healthy condition. They should be clean, fresh and tender without any blemishes. They should be succulent. Between two entries, one with big but fibrous specimens and the other with relatively smaller but succulent specimens, the latter has a better chance of success. The judges prefer to cut the vegetable to test their succulence and texture. Be sure, therefore, not be guided by the size alone of a large pumpkin or cucumber. Peas are generally required to be exhibited with their bloom on. They should, therefore, be clipped carefully with scissors on a cotton-wad to save the bloom.

RESEARCH

A keen gardener has to keep himself up-to-date. Therefore, besides availing of the opportunity of visiting the exhibitions and shows, he should be in touch with the latest research. These days the research results translated into practice and stated in the language understood by progressive gardeners are available in print. Very useful work is being done also by a number of societies, like the Agri-Horticultural Societies, the National Bougainvillea Society, and the National Rose Society etc. in training the amateur gardeners by dissemination of knowledge through printed material, lectures, etc. More gardeners could avail of these facilities.

GLOSSARY

| | |
|---------------------------------|---|
| Annual, biennial, and perennial | A plant which grows flowers, produces seed and dies within a year of sowing its seed is an <i>annual</i> . A plant which completes its life cycle within two years is a <i>biennial</i> , it flowers on the seedlings raised in the previous year. A plant which, once planted, flowers for more than two years is a <i>perennial</i> . |
| Anther, filament and stamen | Male organ of a flower is <i>stamen</i> . Its top is called an <i>anther</i> and the stalk is a <i>filament</i> . |
| Bleeding | Profuse oozing of the sap of a plant on receiving a cut or bruise. |
| Bract | A leaf on floral axis. |
| Calyx | A group of sepals is collectively called <i>calyx</i> . |
| Catkin | A pendulous spike of a flower as in <i>Amaranthus caudatus</i> . |
| Clone | A plant propagated by vegetable method. |
| Compost | Mixture of soil, fertilizers, manure, lime, sand, etc. made ready for planting. |
| Crocks | Broken pieces of earthen pots. |
| Cutting | A vegetative portion detached from a plant and used for propagation. |
| Dead-heading | Removing of dead flowers. |
| Eye and node | Dormant vegetative bud on a stem or a branch of a plant is an eye. A place of attachment of leaf and location of vegetative bud on the stem is a node. |
| Fimbriate | Bordered with hair, fringed. |
| Glaucous | Having a powdery coat on leaves which rubs off. |
| Hardy and semi-hardy | Hardy means capable of living out-doors in winter without |

GLOSSARY

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|------------------------------|---|
| | protection, thus it refers to the plants which are resistant to frost. Plants which are less resistant to frost are known as <i>semi-hardy</i> or <i>half-hardy</i> . |
| Leader | A stem or a branch along which a plant has its main line of growth. |
| Lateral and sub-lateral | A shoot sideways to the leader or main branch is a lateral. A shoot sideways to the lateral branch is a sub-lateral. |
| Inflorescence | An arrangement of flowers on a stem. |
| Petals | Coloured members of a flower. |
| Petiole | Stem of a leaf. |
| Pinch off | Nipping off or rubbing off the growing point. |
| Roguing | Removal of inferior or undesirable plants in a cultivated group. |
| Runners, suckers and stolons | Rooted side-growth at a little distance from the mother plant is a <i>runner</i> . Rooted side-growth at the base of the mother plant is a <i>sucker</i> . A runner above the ground is a <i>stolon</i> . |
| Scape | A flower stalk arising at or beneath the surface of the ground as in tulips. |
| Short-jointed | Vegetative portion with short distance between its nodes or leaf joints. |
| Spit | A depth of full length of the blade of a spade, i.e. 20-25 cm (8-10 in.). |
| Scion and stock | An eye or cutting budded or grafted on a growing plant is known as <i>scion</i> . The plant on which it is grafted is known as <i>stock</i> . |
| Spur | A small shoot projecting from a stem produced annually which bears flowers and fruits. |
| Stigma | The part of female reproductive organ which receives the pollen. |
| Style | The extension from the ovary which supports the stigma. |
| Stool | A clump of plants formed at the base of the mother plant as in chrysanthemums. |
| Terete | Approximately cylindrical, usually tapering at one or both ends. |
| Tomentose | Covered with densely matted hair. |
| Sepals | The outermost part of flowers which envelopes the bud and later supports the petals. |
| Tilth | A well-cultivated soil. |
| Vascular tissues | Vessel or ducts conveying sap in a plant. |
| Wood, new wood and old wood | Vegetative growth in the same season is a new wood. Vegetative growth of the last season or earlier is an old wood. |

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HOME GARDENING

"God *Almighty* first Planted a *Garden*. And indeed, it is the Purest of Humane pleasure. It is the Greatest Refreshment to the Spirits of Man; Without which *Buildings* and *Palaces* are but Grosse Handy-works", so sayeth Fracis Bacon. It is both for the kings and commoners, a worthy pursuit and a preoccupation.

This work provides useful information on the gardening of ornamentals, foliage and fragrant plants, and fruits and vegetables. It guides in planning and landscaping of home gardens, preparing plants for exhibitions, and floral arrangements. Ugly drains are covered with climbers, and sharp corners are cut by informal arrangements and ferns and houseplants cheer up the house. Orchids, cacti and rocks, garden plants for water and terraces find a special place in the book, which is beautifully illustrated. It has a section for kitchen garden, of value with home economy. To the growing volume of information on this subject, this work makes a valuable addition. It should prove of much assistance to the amateur home-gardeners, specially the housewives and the children for growing and maintaining, of their own, a home-garden. It contains valuable personal notes which make the book lively.

About the Author

An administrator and a naturalist, Shrimati Pratibha P. Trivedi is deeply attached to gardening – be it the hills or the plains; the rooftop or the ground.

Born in the undivided Punjab, by the river Jhelum, and brought up in the tribal forests of Madhya Pradesh, the love for gardening comes to Shrimati Trivedi naturally. She took her Master's degree in Mathematics and is a member of the Indian Administrative Service. She has first hand experience of work in the villages, forests and tribal areas and of administration in the states and the centre. She has worked in the Indian Council of Agricultural Research and as Agricultural Production Commissioner, Assam. As Adviser to the Planning Commission, she was in-charge of the Plans of the north-eastern states and union territories. She was Chief Secretary to the Government of Meghalaya and the Government of Assam. She was Secretary to Government of India, Ministry of Personnel, Public Grievances and Pensions.



Shrimati Trivedi was founder-member and the first General-Secretary of the Bougainvillea Society of India and is associated with a number of agrihorticultural societies. She has won many prizes in the flower shows of Shillong and Guwahati. The book is an extension of her hobby of gardening.